THE

ELECTRICAL REVIEW.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

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THE ENGINEERS' STRIKE.

CURIOUSLY enough the *Engineer* of last week propounded the idea that the strike was past help or advice, and the daily press of even date contained a notification from Cantuar and Ebor, which are understood to stand for the Archbishops of Canterbury and York, commending the whole business to prayer. It is recorded among the profane that when two men were cast away in an open boat and felt themselves to be very much *in extremis*, they deemed it necessary to pray. They were unequal to this, so a hymn was suggested. This also proved to be outside the sphere of their practical politics, and, as a last resource, in order that something religious should be done, they had a collection, that perennial joy to the churchgoer which possibly so well answers the oft-repeated cry, "Why do not the poor go to church?" Our good archbishops have seen probably that it is to long-continued collections that the strike owes its continuance, and so they have turned to prayer. Well, this is better than the ill-informed interference of the Bishop of Hereford. On the bishop's interference we cannot do better than quote the *Engineer* as follows:—"If, for example, the bishop could be led to understand the position in which he would be if his coachman refused to permit his lordship to use his carriage as he pleased, limited the hours during which it was to be out of the coach-house, refused to permit anyone else to drive it but himself, settled the rate at which it was to be driven, and the number of individuals it was to carry, and lastly, if dismissed for incompetence, or refusal to obey orders, took all the rest of the bishop's household with him, and then prevented him getting others in their places, we fancy the bishop would regard the position of the employers in the present struggle with a little more favour."

We hope someone has sent this copy of the *Engineer* to the good bishop, because it puts the whole case in a nut-shell. The carriage is a machine in which a rich bishop is carried from place to place, where a poor clerk would have to walk. It is a luxury under the full control of the bishop. A machine tool is a machine costing, as a rule, more than a carriage. It is not a luxury, but is used as a means of obtaining bread and clothing for an employer and his family, and that of the man who is paid to work the machine. Yet this necessity—for a machine tool is a necessity—is to be provided by the employer, housed by him, and he is not to have a word to say as to how it shall be worked, but is to pay a fixed sum to have a man attend to it, and receive himself no return. It is as though the bishop were compelled by his household servants to keep a carriage, but only allowed to use it himself when no one else wanted it.

If the bishop did not approve he could, of course, cease, as the law now stands, to use it, he could cut off his carriage and the annoyance at once. He could walk, and no one would be the worse, except the coachman; indeed, the bishop would probably benefit by the exercise. But England would not suffer by the suppression of 50 bishops' luxuries.

England does suffer if a single machine tool is stopped or hindered, and the very men suffer the most who are doing the evil deed. Last week we proposed a new form of trades union which we hoped might at least provide food for thoughts that would lead to something being done. Further thought on the subject has not moved us from our feeling that the scheme, we ventured to propound, has in it the elements of success. We know the difficulties in the way. Men have been too prone to throw aside the decision of arbitration when it suited them to do so. The employers repudiate outside interference, for they have already had so much of it with such ruinous results, that they are strong in their refusal to budge an inch. We do not wish to appear unduly unfavourable to the men, but we are, and have been, convinced that their executive are elected or appointed in a wrong manner. We think that if our suggestion of a permanent joint committee could be brought about, the men's representatives should be drawn from the various districts in the country according to number of members in the different districts. No man should serve longer than, say, three years, and every year one-third would retire and go back to the bench. The pay of a member should be little more than his wages. Votes should accrue to the men for purposes of election in the ratio of their years of membership. This would steady the ship greatly.

As the war is now going on again in full blast, we would appeal to the men, especially to the older and steadier among them, to carefully consider their present status, and the true facts of the present dispute. We would ask them, Does it appeal to your common sense that machinery should be run slowly to reduce its output? Does this cause commend itself to you as a means for you to earn higher wages? Does it not occur to you that the mechanics of America, whose skill as a mass is not greater than that of the labourers who work machines in English shops, are earning bigger wages very largely because American shop management is conducted upon the lines you are fighting against? Can you not see that your persistence in your present course can have only one of two endings? Either you must be hopelessly beaten, or trade will go to foreign countries, and very few of you will get back again to work. Can you not already see that you are fighting against sense and reason, as did the mistaken Luddites and machine wreckers generally? We tell you plainly you cannot win this battle, into which we know from conversation with many of you, you have been driven by a fatuous and wicked policy. For six months you have been fighting, and for what end? If you are wise, you will reconsider your position and place trades unionism on a sound basis. You will put a stop to the use of benefit funds for fighting purposes. You will have a secretary whom you can dismiss at a day's notice if he misbehaves himself, or mistakes himself for the Almighty.

Above all, beware of talkers. When a man like John Burns goes on a platform and says he will have the strike all over in a fortnight, as he did say half a year ago, you believe him; you always do believe these stump orators; they turn a working man inside out, because working men, as a rule, are not prone to making speeches, and are apt to take the ability to talk as evidence of wisdom. Are not the sufferings of the past half year a severe enough lesson for believing Mr. Burns, that you must still go on believing men who are leading you deeper and deeper into the depths of misery and poverty? Do you not know that every week sees the workshops getting into fuller work *without your aid*, and that unskilled labourers and apprentices are proving the possibility of easily doing more and better work than your executive has been allowing you to do, on the pretence that, to obtain a full day's pay for half a day's work, is to your benefit? Can it be possible that you believe these absurdities? Are you willing to allow Mr. Barnes to continue to trade on your simple trust? There are about half a million men in the engineering trade, and only about 80,000 of them are members of the A.S.E.; of these 80,000 there are 55,000 at work under the very conditions which you are striving against, and they do not complain, but are earning good wages, working overtime, and paying levies to keep you idlers half fed. There are 25,000 of you, or, perhaps, now nearly 30,000, undergoing semi-starvation for a false idea. One man of you is out of work for every 19 men, unionist and non-unionist at work. Are you willing to go on with a hopeless fight while the other 19 are in full swing? Go back to work. See to it that English workshops turn out as much per man as the workshops of America, by putting a stop to this folly of restriction. Let the employers have a free hand to manage their business and a heart to seek orders and take contracts with no misgiving, and then ask them to raise your pay.

If you act as above, the profits of the employers will be so ample that not one of them will care to risk their stoppage by refusing your proper demand. In the present dispute you have made an unreasonable demand upon your employers, and you have been in the position of a footpad, who, in asking a man for his purse, has given him the alternative of death by shooting if he acceded or by drowning if he refused. Even a coward will fight if he must otherwise die. You have compelled your employers to fight for their lives, and you have been beaten; and if you had won, there are two men behind the hedge would take the spoil, and leave you as dead as your employer. These two men behind the hedge are encouraging you, and helping you to fight your employer until you are both exhausted. Their contributions will cease as soon as they see both you and your employer have bled each other to death.

Men of the Amalgamated Society of Engineers! have you positively ascertained that among the agitators who are goading you on to your doom there is not one who is in the pay of Germany or America?

Note on Helium and Argon.—An attempt has been made to cause helium or argon to pass through red-hot metals, such as iron, palladium, and platinum, and the results form the subject of a paper by Prof. William Ramsay and Morris W. Travers, which was communicated to the Royal Society on May 14th. To chronicle experiments which produce no result is a necessity, though not entirely an agreeable one. Whatever the reason of the passage of hydrogen through red-hot iron, and through moderately heated palladium and platinum—whether it be due to the solubility of the gas in the metal, or to the formation of an easily decomposable compound—neither argon or helium is able to pass through any one of these metals, even at a fairly high temperature. This would imply their inability to form any compound, however unstable, with these metals, or to dissolve in them at a red heat. Such inactivity is in accordance with their general behaviour, and is still another proof of their inertness.

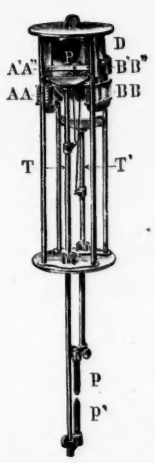
HENRION'S ALTERNATING ARC LAMP.*

By M. ALIAMET.

ALTERNATING current arc lamps are beginning to be somewhat extensively used, and, with the exception of a few rare types, their regulating mechanism does not act very satisfactorily with the alternating current, at any rate with frequencies included between 39 and 45, these being the prevailing limits in France at least.

The firm of Fabius Henrion, which at one time brought about a revolution in the market of continuous current arc lamps by bringing out the Pilsen lamp, has just produced a regulator for alternating current lamps, with an asynchronous reversible motor to effect the regulation.

Principle.—The two carbon-holders, *p p'* (see figure), are balanced and kept in position by a band to which they are



suspended. This band passes into the groove of a pulley, P, on the axle of which is mounted a disc, D, of red copper.

It is this disc that, by turning in one direction or the other, separates the carbons or brings them together. The rotary movement is obtained by the following arrangement:

An electro-magnet, A A, with a core of insulated sheet-iron, has its pole-pieces shaped in the form of jaws, A' A", between which comes the edge of the disc, D. The bobbins of this electro are connected in series with the arc, and the play between the disc, D, and the pole-pieces, A' A", is reduced to a minimum.

When the current passes through the bobbins it generates an alternating flow in the electro-magnet; this flow is closed in the air on passing through the disc, D. The flow produced by the bobbins agrees within very little, with the difference of potential at the terminals of the lamp, whereas the magnetic field developed by the currents induced in the disc, D, lags by about a quarter of a period behind this difference of potential.

Repulsion is then produced between the periphery of the disc and the pole-pieces, the effect being of the kind of the electro-dynamic repulsions discovered by Elihu Thomson in 1884. Every point of the disc tends to be repelled in an upward direction, away from the field of the electro-magnet A A' A". The disc then turns in the direction of the hands of a watch; moreover, the couple is greater in proportion as the intensity of current is stronger. At B B, B' B" is another electro-magnet, the bobbins of which are connected in derivation on the terminals of the lamp. This magnet tends to make the disc revolve in the opposite direction to the hands of a watch by the very fact of its symmetrical position with regard to the magnet A A' A". The couple produced in this last case is in proportion to the ampere-turns acting on the magnet B B' B", *i.e.*, to the difference of potential at the terminals or to the length of the arc.

Lastly, the disc, D, acts as the armature of an asynchronous motor with two independent inductive fields acting in opposite directions on this common armature. The rest of the construction of this lamp reminds us very much of the Pilsen model. There is the same case, the same guiding apparatus for the carbon-holders, T T', which pass through the lower base of the case, being guided by three rollers placed in three planes 120° apart. This arrangement ensures the perfect centreing of the carbons.

Working.—When the current is sent through, the carbons being separated, for instance, the magnet, B B' B", acts alone, and makes the disc, D, revolve so as to bring the carbons together. When they are in contact, the current passes into the electro-magnet, A A' A", and makes the disc revolve, thus separating the carbons, for, at the moment of contact, the electro-magnet, B B' B", ceases to act. The arc being thus lighted, regulates itself according to the predominance of effect of the A A' A" or B B' B".

The lamp is therefore differential, and a recoil can always be produced and the arc relighted when, through any cause, the carbons come in contact. The production of this recoil is a necessary consequence of the independence of action of the magnets in series and in derivation.

The lamp is regulated to work at 33 volts, so that three can be connected in series at 110 volts.

Two types are in course of construction which only differ in the length of the working range of the carbon-holders. The smaller model enables 400 mm. of carbons to be used, and allows of from 6 to 10 hours of lighting.

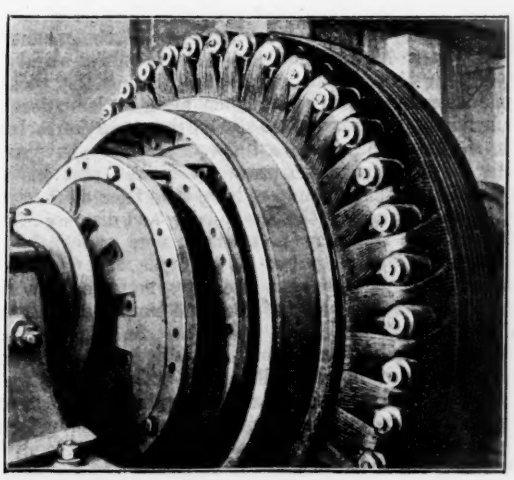
The larger model has a length of 560 mm., and, according to the diameter of the carbons, has a duration of 8 to 16 hours.

The steadiness of the light is guaranteed, and also the fact that the lamp requires no attention or cleaning. It seems that the motor answers to a variation in E.M.F. of ·1 of a volt, which seems somewhat exaggerated. What surprises us somewhat in this lamp is the absence of any slackening apparatus for the purpose of avoiding pumping.

* *L'Electricien.*

GENERATORS IN THE UNION LOOP STATION.*

THE illustration represents the armature and commutator of one of the Siemens & Halske 1,500-kw. generators now being installed in the Union Loop power house in Chicago. The arrangement of the armature winding and the connections to the commutator are clearly shown. This construction has all the advantages of internal fields; great radiating



surface and maximum magnetic effect are to be found. The commutator is on the armature spider, and its construction and insulation are for large current capacity and long life. The armature winding is such as to give good ventilation. The poles will be 16 in number.

The armature was entirely assembled at the company's works and had to be transported on a special car, on account of its great size and weight. For such service the company has designed and built two or three flat cars, with two out-

* *Street Railway Review.*

board bearings, on either side of the car near the middle. The armature shaft rests on these bearings and part of the armature projects beneath the car floor, but far enough above the roadbed to prevent any damage from obstructions there. By this means armatures of very large diameter can be transported and come beneath the limit of height prescribed by the railroad companies. This armature had to be moved for some distance through the streets, from the tracks of the Chicago & Northern Pacific to the station. The trucks were removed from under the car body and it was let down on skids and pulled along on rollers by means of a capstan. The rest of the machine is so divided as to be easily handled.

This is the first of three machines to be installed in a short time, and the work on the station is being pushed as rapidly as possible.

CANDLE-POWER OF ARC LAMPS.

We (*Canadian Electrical News*) have already had occasion to refer to the candle-power of arc lamps, and the very indefinite way of specifying it. It seems to have become fixed in the minds of a large number of persons that a 9·6 ampere arc lamp will give 2,000 candle-power, and that a 6·8 ampere will give 1,200 C.P. When, therefore, such lamps are put into circuit, and seem to give a light deemed not up to their standards, disappointment and dissatisfaction result. The manufacturing companies are blamed for trying to sell under worthless guarantees, and the customer considers himself badly treated. Now, it is not the business of this journal to take the part of manufacturers against the public, but we deem it in the true interests of the electrical industry to point out to our operating readers that the above dissatisfaction is most emphatically largely their own fault. A man who does not take the trouble to study the details of a business out of which he makes his living almost deserves to be deceived, more especially when the whole literature of the subject is at his disposal, is extremely interesting, and written in a state to suit not only the technical, but also the popular reader. When purchasing an arc dynamo the purchaser usually asks for a 2,000 or a 1,200 C.P. outfit, and without giving the matter a moment's thought, concludes that a "nominal" 2,000 C.P. lamp will give actually 2,000 C.P. If he were to devote to the subject as much thought as he gives to the purchase of a hand lamp for his kitchen—to use oil—it would probably occur to him that just as the amount of light given to his coal oil lamp depends on the quality of the oil, the size of the wick, and whether the wick is turned up or down, so the light given by an arc lamp depends not merely on the current, but also on the quality of carbons, their size, and the distance between their points. As a matter of fact, anyone can prove for himself that one can get more light from a 5-ampere lamp than from a 10-ampere one, by simply varying the size, quality and distance of the carbons. An arc lamp is nothing more or less than a mechanism for keeping two carbon rods always a little distance apart, and the lamp itself has no more to do with the light than has the bulb of the hand lamp that holds the oil, or the screw that raises the wick. So that if a purchaser desires to buy arc lamps properly, he should not ask for one of a particular candle-power, but for one adapted for the use of a certain current to maintain the carbon rods a certain distance apart, and with a certain drop of potential across its terminals. The candle-power is then entirely his own affair, and if he wishes to be very severe in his requirements he will then need to specify that with such a lamp as above, and using carbons of such and such a particular make, the candle-power observed at such and such a distance from the crater, and at a specified angle from the horizontal plane passing through the crater, must be what he considers he wants. With a specification such as this he is equipped and is in a position to talk to manufacturers, but to consider himself badly treated and deceived because a lamp bought as a supposed 2,000-C.P. does not give it with any kind and size of carbon, and at any distance from the ground, is just about as business-like as to buy a heating stove without saying whether it is to burn wood or coal. As a matter of fact it has been over and over again again proved that a nominal 2,000 candle-power lamp does not give more than 800 C.P. in the most intense direction with ordinary carbons, &c. If the electrical operating industry would take a hold of its interests a little better and would dictate its requirements it would be better for both operators and manufacturers.

ONE OF THE USEFUL APPLICATIONS OF THE STORAGE BATTERY.*

By WILLIAM BAXTER, Jun.

When the storage battery first came prominently before the world, it was thought that its great field of usefulness would be that of the transportation of energy from coal fields and large water power sites to centres of industry. It was also believed that it would enable the electric motor to become a formidable rival of the steam locomotive, not only because it would reduce the cost of hauling a train, but because, in addition, it would remove many of the objectionable features of steam transit, such as smoke, cinders, &c. When put to the test it was found that the batteries, at least as then constructed, could not withstand the hard usage to which they were subjected in railway work; and as to their value as transferrers of energy from the source of supply to the points of demand, it was found upon investigation that they could not compete with existing methods, even if made sufficiently substantial to endure constant usage with slight deterioration, and so perfect electrically as to have the greatest storage capacity, per unit of weight, consistent with theoretical possibilities. In this latter field they would necessarily fail, because, if made as light as possible, they would weigh at least 12 lbs. for each horse-power hour capacity, and as good steam engines can develop the same amount of energy from 3 or 4 lbs. of coal, the weight of batteries to be transported back and forth would be three to four times that of the coal necessary to do the same work. The batteries then made weighed from 150 to 200 lbs. per horse-power hour capacity, instead of 12; hence, the difference in weight to be transported under the actual conditions was so great as to render it impossible to accomplish anything practical in that field, even if the energy could be obtained free of cost.

When it was seen that the storage battery could not accomplish anything of a revolutionary character, those interested in its development began to study its adaptability to less pretentious work, and soon realised that it would be decidedly valuable as an adjunct to electric lighting stations, as it would be to these what the gasometer is to a gas distributing system—a reservoir from which the demand of customers could be supplied, should it become necessary at any time to stop the machinery for a few hours. Without the aid of storage batteries, if from any cause the operation of the generators is suspended, the lights will instantly go out and remain out until the generators are set in motion again. After years of persistent and very commendable experimental work, the inventors of storage batteries succeeded in making these devices sufficiently durable to withstand the wear and tear they are subjected to in station work, without unreasonable deterioration. Since that time they have been used to a considerable extent in that field, and within the last two years their use has been increasing at a very rapid rate; in fact, a first-class station of to-day would not be considered complete without a storage battery plant.

The first battery plants installed in lighting stations were intended simply as a safeguard, to render it possible to keep up a supply of current in case of accident to the machinery; but it was not long before it was realised that by enlarging the capacity of the batteries, the output of the station could be greatly increased without materially increasing the expense of operation. How this result can be accomplished will be readily understood when it is considered that the demand for light is not uniform throughout the whole 24 hours, but varies from little or nothing, during the day and the early hours after midnight, up to to the maximum

* *Scientific American.*

amount between 9 and 10 in the evening. The station capacity, however, must be sufficient to meet the greatest demand; therefore, during the greater part of the time the machinery is only worked to a fraction of its full capacity. By using storage batteries, the generators can be worked to their full capacity all the time, and when the demand of consumers is small the surplus energy is stored, to be given out when the demand is in excess of the amount developed by the machinery.

From the very fact that the demand for current is variable, it becomes possible for batteries to be used not only to reduce the cost of production and increase the capacity of the station, but also to reduce the cost of line wires. This last result can be accomplished in any case where the station is located at some distance from the district in which the current is distributed. To illustrate this point, suppose the station is located, say, one mile from the centre of the city or town in which the lights are used. If the current runs direct from the generators to the customers' lamps, the line wires must be of sufficient size to carry the maximum supply with a loss of pressure low enough to not interfere with the brilliancy of the light. If the maximum demand lasted for a considerable portion of the day, the full capacity of the line wire would be used to a reasonable extent, but the duration of this maximum demand is seldom over one-half, or, at the most, one hour; therefore, during the rest of the time a large portion of the line capacity may be regarded as wasted. The difference between the average and the greatest demand varies within wide limits, in different stations, but in the majority the ratio is not much below one to two. Whatever it may be, however, if the current could be supplied at the average rate, and the excess over the demand when the consumption is small were stored, the amount so stored could be used to supply the deficiency when the demand is large. This is accomplished in many cases at the present time by placing a storage battery plant at the centre of the district in which the customers are located. The wires coming from the generating station are so connected with the battery and the distributing mains that, whenever the drain is less than the current coming from the station, the batteries are charged, and when the demand is in excess of the current from the station, the battery feeds into the distributing mains. The current passing from the generating station to the battery station is about 10 per cent. more than the average demand, so as to cover the loss in the charging and discharging of the batteries.

The saving in wire by this arrangement will run from about 25 to 75 per cent., depending upon the relation between the average and the maximum current, and also upon the amount of energy that is lost in transmitting the current from the generators to the battery. When the generating station feeds directly into the distributing mains, the loss of energy in transmission is governed by the condition that the pressure of the current must not drop so much as to interfere with the brilliancy of the lights, and therefore, the line loss is generally low; but when batteries are used, located at the centre of distribution, they regulate the pressure of the current supplied to the lamps; and, therefore, the loss between generator and battery may be made anything desired, without affecting the brilliancy of the lights. If the power is obtained from a waterfall or from coal near a railroad, when it can be obtained at a very low price, it may be more economical to increase the loss of energy between generator and battery, and thus reduce the cost of line wire, but such conditions cannot be taken advantage of if the battery is not used.

ELECTRICAL BOOKS—PRACTICAL AND ELEMENTARY.

"Oh, that mine enemy would write a book!" is a wish that might not inaptly proceed from the thoughts of many a practical electrical engineer to-day, for undoubtedly were the said enemy to do so, it may be taken for granted that the work would be constructed upon the same lines that have now apparently become stereotyped, and thus would arise the opportunity for attack. Perchance from out of the resulting conflict might arise some truths that would impress themselves upon those who seek to impart their knowledge of electrical engineering to their less learned brethren. That the writers responsible for many existing treatises have not been assailed more often is possibly due to the imposing effect of the professional character and reputation that surround them, or it may be that they are fortunate enough to exist without enemies.

Nevertheless, it is a fact that a current of opinion is commencing to flow, which will, sooner or later—and the sooner the better—sweep away not a few prevailing opinions as to the proper manner of compiling the works required by the electrical engineer for the furtherance of his knowledge.

Almost the first impression that one receives after studying a few of these books, both those recognised as standards, and others of less note, is that each individual author seems to arrogate to himself the honour of being the reader's sole teacher of all the elementary facts regarding electricity. In the case of a work that is not only professedly but *actually* introductory to the study of a subject, no objection of this nature can reasonably be made. The majority, however, while claiming on their title pages, or in the prefaces, to be elementary, have, as a matter of fact, ceased to be so, long before the concluding chapter is reached. In a very limited sense they may indeed be termed "elementary," but for all practical purposes this description is misleading, and affords no complete and real intimation of the nature of the contents. A work that, for instance, discusses, amongst other things, the design of 500 kw. dynamos, the effects of self-induction in alternators or combinations of resistance, self-induction and capacity of transformer circuits, cannot fairly be regarded as elementary, even though it also deals in its early part with the units of measurement or the method of calculating horse-power. While it is true that instruction in first principles is necessary in order that a grasp of any branch of electrical science may be obtained, it does not follow that the beginner should be dragged through the whole range of electrical engineering in one volume; and, conversely, the man who has passed the initial stages should not be expected to go over again and again work with which he already is conversant. Some day it will dawn upon a writer that the average engineer who seeks to enlarge his knowledge has gone through the electrical alphabet, and no more requires to repeat his letters than he does to learn his own name. Then all those points of information which at present seem to be included in the majority of works—the statements regarding the supposed natures of electricity, the description of simple experiments from the rubbing of amber or sealing wax, to that hoary-headed and inevitable old friend, the demonstration of the lines of magnetic force by means of iron filings on a card,—these and the multitude of others will become incorporated into true elementary works alone. Everything has its place, and there is just cause for complaint at the inclusion of these facts in works that subsequently attain to heights quite above the reach, for some time to come, of the learner who is a learner from the beginning.

The practice is to be regretted for more reasons than one. Even in the case of those who have justly earned the right to be regarded as the authors of standard works, it would undeniably be of benefit to their writings if a division into different volumes of elementary, middle, and advanced stages were made. Thus each course would receive more ample and explicit treatment than is now practicable, owing to the necessity of paying due regard to considerations of space.

To the electrical engineer a technical library of his own is an absolute necessity; more often than not it is formed slowly, for generally the princely remunerations that are the rule in this, the richest country in the world, become in most cases attenuated almost to the vanishing point when the ordinary cost of living has been met, and consequently books can only be indulged in at infrequent intervals. When the majority of works that in their main part are really helpful to the practical man, each contain from one to five, or more, chapters devoted to the simple elementary principles of electricity before proceeding to instruct in modern methods and applications (the matter that sells the book), an injustice is done to the purchaser, who has to take what he does not want, in order to obtain that which he does. It may perhaps be contended that one or two standard works on any theme contain practically all that the average man requires to know,

therefore no real ground for objection to the inclusion of the introductory course exists, seeing that these are sufficient in themselves for instruction in the subject they deal with.

Admitting, for the sake of argument, that it is not necessary to possess more than this number, there still remains the fact that knowledge should be imparted in accordance with the needs of the learner. To assume a man's complete ignorance of everything connected with electricity because he asks for information on dynamo design or polyphase power transmission practice is nothing less than to offer him an insult. A writer on the derivation of language does not commence a treatise by instructing his readers how to spell, neither does the political economist consider it necessary to first explain to his disciples the meaning of such words as "land," "king," or "people." And yet this is precisely the kind of error that so many writers of electrical books commit to-day! With the class of works compiled expressly for the use of the students of A Technical College, or B Engineering Institution these remarks are not now dealing. Such form a class to themselves, and exist for a specified purpose that is distinct from the one under discussion. But in the case of those put forward for the use of the practical electrical engineer—the man who is engaged in handling, operating, or manufacturing apparatus and plant—it is time that attention should be paid to actual requirements.

The present mode of treatment would appear to be a survival of that past day when the various branches of electrical science were more or less in an embryo state—when, in fact, electricity was "in its infancy"—and could be adequately dealt with between the covers of one volume. The advance of knowledge has already brought us specialised works; it yet remains to separate in these the elementary portions from the more advanced. With the accomplishment of this "consummation devoutly to be wished" will come a satisfaction to the young beginner, to the practical man, and last, but not least, to the author.

SOME PRACTICAL POINTS ON THE DESIGN OF A SHUNT DYNAMO.

By V. ZINGLER, A.I.E.E.

So much has been written, and is still being written, on the design of dynamos as they now are, that it is, perhaps, difficult to attack the subject from any point of view without having been anticipated, or in default of this, without being expected to say something quite new or to announce some startling discovery. It has, however, occurred to the writer that very little is found either in text-books or in papers, other than the theoretical discussion of the question, and if examples of building up and winding are given, they are usually obtained by working backwards from a dynamo which the author has before him, or of which he has all the finished data; or else the usual well-known formulæ are given and the winding is then laid on—piled on—as it were, without any reference to small details of insulation, &c., which are so absolutely necessary in making out specifications for the shops—quite apart from considerations of a physical kind.

The object of these notes is, therefore, not to discuss formulæ or the methods by which they are arrived at (it will be assumed that the reader is acquainted with the dynamo design as set forth in text-books, and the elementary theory of magnetism), but an attempt will be made to show how a dynamo may be calculated from first principles so that it may be put into the shops, and so that the winding as specified by the calculations will actually go on. In order to simplify matters we will take an ordinary two-pole inverted shunt dynamo with drum armature, a type such as is perhaps more frequently employed than any other. The methods we employ for winding this machine will of course hold good—as far as mechanical considerations go—for any other type of machine; the electrical considerations will, of course, vary according to the type of machine, but with these it is not proposed to deal, except so far as they concern the particular machine under discussion; the designer will use the same methods for winding different types of machines, and in accordance with his particular shop practice, although many other *forms* of winding have to be employed to give the various electrical duties required from more complex types of machines. The words "shop practice" are perhaps the only ones which raise any difficulty in the subject before us and which obliges us to assume something; for every shop has its own particular data as to insulation of the various parts of the machines, thickness of insulation for different voltages, method of forming armature bars, of winding same on the core and so on—which ultimately determine the whole method of building up the machine, although its efficiency and weight for output may be the same in any number of shops. The designer has therefore to fix on certain insulating materials, to gauge them accurately and to always keep these figures before him as constants. He has also to decide on a definite way of building his machine and then to use these constants in his calculations for winding.

We will, therefore, decide on building our machine in a definite way, and perhaps the simplest case is to assume that the armature should be built up of round core discs and the bars or wires laid on the periphery and keyed by wooden pegs, thus forming part of the air-gap. We will also assume that the bars are built up of copper strips of a minimum gauge of ·036 inch, placed edgeways on the core; the component strips of one bar being separated by thin paper to stop eddy currents. The bars will be wound round with shellaced cotton or other tape to a thickness of ·02 inch; the armature core will be insulated from the bars by means of pressspahn or other insulating material to the thickness of ·05 inch; and the finished armature will be bound with piano wire over mica insertion to thickness of, say, ·065 inch. These figures are such as are used in actual practice, and may, for convenience of reference, be tabulated thus:—

Insulation on bars	·02	inch.
„ „ wire (d.c.c.)	·008	„
„ „ core	·05	„
Wire bands and mica	·065	„
Paper	·003	„
Minimum copper strip	·036	„

In any case, the designer will gauge the particular materials he proposes to use and endeavour to see that these do not vary in thickness.

In order to more easily demonstrate the process of winding, we may assume that a machine of a certain output is required, and that there are no other data to hand by which this machine can be approximated from others. For when a dynamo has once been built and another is required which varies only slightly in amperes, speed, or volts, or any combination of these, it is seldom necessary to do more than to alter either the winding of the armature, the section of the iron, or the winding of the fields. Dynamos of any one type are rated by the number of watts per revolution, and it is found in practice that, after taking a certain diameter of armature, a machine can be built round this up to a limited number of watts per revolution only—that is, after the armature has become twice the length of its diameter, in order to allow for an increased section of iron; or after the current has become so big that the size of bars required to carry it have reduced the number of bars to less than 40; or if the field winding takes up so much room that it cannot be put on the magnets without causing serious overheating due to want of radiating space; these, and several other factors, determine a figure for the watts per revolution (= w.p.r.), after which it becomes necessary to take a larger diameter for the armature.

Having then established a certain number of sizes of machines as fixed by their armature diameters or w.p.r., we can, within limits, tell at a glance on seeing the output required for a dynamo, what size of machine to take. This, of course, would not apply to plating dynamos or high voltage machines.

We will now take a machine with the following output:—400 amperes, 80 volts, 320 revolutions per minute (an Admiralty size). This gives 100 w.p.r.

We have now to decide on the size of armature, and it may be convenient to standardise our armatures by the diameter of the bore of the magnets—that is, the diameter of the armature if the air-gap were infinitely small. This allows us to vary the depth of winding or the diameter of the core plates without reference to the diameter of the

armature. The question therefore arises: given our output, what sized armature shall be taken. This we can arrive at approximately in the following manner. Our fundamental equation is:—

$$N = \frac{E \times 60 \times 10^8}{n \times c}$$

where N = total number of magnetic lines.
n = revolutions per second.
c = number of convolutions or bars.

It is clear then that c is the only quantity wanting to determine N. Now, in fixing c, we are met by two considerations: (1) that c should not be much greater than 160 owing to expense, or below 40 owing to sparking; also (2) that it should be an even integer and preferably divisible by 8. Let us take $c = 120$, which will give us approximately the value we require for N, and will allow of altering the actual number of bars afterwards either way.

We therefore get

$$N = \frac{80 \times 60 \times 10^8}{320 \times 120}$$

$$= 12{\cdot}5 \times 10^6 \text{ nearly.}$$

To N we should add 10 per cent. for armature and demagnetisation losses $= 13{\cdot}75 \times 10^6$. Assuming our induction in the core to be 10,000 lines per square centimetre, this gives a total area of 1,375 square centimetres. To this we must again add about 20 per cent. to allow for the shaft, whose permeability will be much lower than that of the soft iron core, and also for the ventilation shafts through the core—always assuming that the armature is very little longer than its diameter.

This gives us 1,650 sq. cms., or about 250 sq. ins. to deal with. Now we have 120 conductors, and assuming a depth of bar of ·5 in., and a current density of 1,500 per sq. in., the area of bars will be

$$\frac{200}{1{,}500} = {\cdot}1333 \text{ sq. in,}$$

and the breadth of bar = ·266 in., or with paper insulation, &c., about ·325 in.

The total periphery required will thus be

·325 × 120 + say 2 inches for pegs = 41 inches say 42 inches,

and the diameter of core

$$= \frac{42}{\pi} = 13\tfrac{1}{2} \text{ inches.}$$

The length of core will be

$$\frac{250}{13{\cdot}5} = 18{\cdot}5 \text{ inches.}$$

The core for 120 bars is thus $13\frac{1}{2}$ inches × $18\frac{1}{2}$ inches.

But as our desire is to make the core nearly square, even if a few more bars are put on, it can be made

$$15\tfrac{1}{2} \times 16 = 250 \text{ sq. ins. nearly.}$$

Now, assuming $\frac{3}{4}$-inch air-gap all round (our bars are $\frac{1}{2}$ inch deep), this gives us 15 inches + $1\frac{1}{2}$ inch, or, say, 17 inches for bore of pole-pieces, or armature rating.

Having now fixed the size of the armature (and as explained before, this can be done forthwith after a little experience), we can proceed with the proper winding. We have:

Current density, 1,500

Area of bars, $\frac{200}{1{,}500}$	...	=	·1333 sq in.
Depth of bar	... ...	...	·5 inch.
Width of bar $\frac{\cdot1333}{\cdot5}$	...	=	·2666 inch.
Minimum of gauge of strips		=	·036 inch.
Say seven strips, each ·038	...	=	·266 inch.

Bars.—The bar will now be built up as follows:—

Copper, width	... ...	=	·266 inch.
Paper = 6 × ·003	... ...	=	·018 inch.
Insulation ·02 × 2	... ...	=	·040 inch.
Width of bar	...	=	·324 inch.

Also

Copper, depth	... ...	=	·500 inch.
Insulation	... ...	=	·040 inch.
Depth of bar	...	=	·54 inch.

Air-Gap.—

Depth of two bars	... ...	=	1·08 inch.
Insulation on core = ·05 × 2		=	·10 inch.
Wire bands and mica = ·065 × 2		=	·13 inch.
Clearance $\frac{1}{8}$ inch all round	...	=	·25 inch.
Total air-gap	...	=	1·56 inch.

(To be continued.)

ACCUMULATOR TRACTION.

By R. KENNEDY.

PROF. AYRTON, in his remarks on this subject in criticising Mr. Epstein's paper, gives a table on p. 860, No. 1,047, December 17th, 1897, of the ELECTRICAL REVIEW, which would have been of great value had another column, giving the rate of discharge per pound of plates, or, better still, per pound of positive plates, at which the watt-hours capacity per pound gross was obtained for the last column.

For the purpose of the worthy Professor the table is all that is required, and his allowance of nine watt-hours per pound of battery is a very generous one considering all things. But that table, like many others given regarding storage batteries, is apt to be used by other people for other purposes, which the addition of a column of rate of discharge per pound of plates would have effectually defeated. Further, it ought to be pointed out that the results of tests on a 7-plate cell cannot be compared with the results of tests on a 17-plate cell; the table shows this clearly.

It is high time for electrical engineers to agree upon some orderly method of tabulating battery performances; at present complete chaos exists, so that fair comparisons are impossible. In any case the watt-hours discharge per pound must always be taken, with the rate of discharge per pound, and the cells compared must be of nearly the same rate of amperes discharge. If these two simple precautions are omitted the figures are valueless for comparative purposes.

The mean P.D. is not a matter of much importance, as in most cells it makes little difference in the total watt-hours whether it is 1·9 or 1·8, or even 1·7 volts; but it makes a vast difference if one cell is discharged at 0·75 amperes and another at 1·0 per pound of plates.

CORRESPONDENCE.

A Defence of Germany.

I regret to notice in No. 1,048 of the ELECTRICAL REVIEW, under "Notes," a rambling rhapsodical recitation: "A Daniel come to Judgment," launched against the head of a neighbouring and friendly nation, against a Sovereign just as highly esteemed in Germany as Her Gracious Majesty Queen Victoria is in Great Britain and Ireland. If such contributions were the reciprocal effusion of bad temper, they might perhaps be explainable; but Germans have never gone so far, and a feeling of international decency will always prevent them from personal insults of other nation's monarchical personages.

It would be the proper thing to ignore similar productions, if they were not the outcome of a widespread contagious disease, which threatens in England to assume an alarmingly dangerous character. What must be the standard of mind of authors who produce such discord-sowing rhapsodies! Do they really dream for a moment that their assaults would change the conduct of the performers of their imaginary or wilfully distorted complaints. Certainly such assump-

tion would be ridiculous, especially in a country whose educational standard is continuously and emphatically recommended for emulation, by the highest statesmen in England, such as by Lord Rosebery at Colchester, by the Marquis of Salisbury's nephew, Mr. Balfour, at Sheffield; by Mr. W. Woodall, M.P., and Imperial counsellor of technical education; by Mr. A. J. Mundella, M.P., at Birmingham; Sir A. Arnold, President of the London County Council; Mr. John Morley, M.P.; Sir Henry Roscoe, and the Duke of Devonshire; Lord Playfair, writer, politician, and M.P.; Mr. Doxford, M.P., one of the most celebrated ship-builders; also recommended at the opening of the Davy-Faraday Research Laboratory by the Prince of Wales (the laboratory is a present of the value of £100,000 gratuitously given to the English nation by the German chemist, Dr. Ludwig Mond); as also recommended by many others, including even Mr. H. M. Stanley, M.P., of "dark country" fame; the press, as for instance, the *Daily Telegraph*, of November 20th of last year, and "last, but not least," by the *Board of Trade Journal* in the December number of the same year.

What then could such discord-hunting epistles aim at? Do they intend to hit German self-esteem and national enviousness, or do they perhaps wish to contribute to a desired change in the new course of national economy and commercial policy in Germany in favour of English interests? I can assure you most emphatically that neither one nor the other could be attained by any such chauvinistic writing. The German people, who read English papers very much indeed, are by this time fully accustomed to see through the coarse meshes of clumsily distorted misrepresentations. They recognise at the bottom, under the sieve, the real motive of the outburst, which is always the result of some political or commercial disappointment, which could not be helped, and they look at it, to say the least, with equanimity and smilingly.

With regard to the new course of German commercial policy, no light-handed talking could have the slightest effect upon it, as it not even depends upon the wish nor the will of the nation, but is forced upon the country and laid down by the inflexible laws of nature. On this point, and with the hearty desire to arrive to a mutual understanding, I beg you to grant a German with 25 years' residence in England a few more words.

The greatest modern politician of Great Britain, Joseph Chamberlain, expressed at the Birmingham Chamber of Commerce, if not in exactly the same words, but as near as I can repeat them, the following doctrine: "The culminating point of governmental triumph consists in the extension and security of commerce. One must, however, never forget that other nations have the same desire as we in England, and that the demand of Germany, France, and Russia for colonial extension must be principally attributed to the longing for buying, selling and profiting!" In these few sentences the experienced politician and shrewd business man laid down the principle of policy of civilised nations, the fulcrum upon which all business and political transactions now-a-days are supported. Another great Englishman of the present day, the Viscount Wolseley, has said: "Cosmopolitanism is the excrescence of an unhealthy civilisation, and the product of a senseless and unpatriotic philosophy."

These dogmas, although recently uttered, are not at all new; in fact, one might say they were recognised and religiously followed in England since 300 years. They were the prime motor during the long and destructive wars against the Spaniards, Dutch and French; they achieved the exclusion of the German Hansa, destroyed armadas and empires, which even in those days were more extended than the British Empire of to-day. The same political dogma, with the help of German troops and the timely arrival of Blucher, crushed at Waterloo the ambition of Napoleon, who craved to dispute the supremacy of English commerce at sea. If this supremacy, since the accession of Queen Elizabeth, was not always the primary cause of English wars, it certainly was always the leading principle in concluding peace. England, by these principles, and the political testament of Elizabeth—"to be friends with all, and allied with nobody," became a self-relying, commercial and naval nation of the very first rank. It is, therefore, perhaps natural, that this supremacy at sea, and of commerce, supported by an enormous accumulation of wealth, should have created a national feeling, that a monopoly of commerce and a claim on any part of the globe, not yet included in the sphere of civilised nations, should fall to Great Britain as an inheritance of priority, there we arrive at the foundation of all the evil!

"*Tempora mutantur et nos mutamur in illis.*" During the centuries when England was fighting for the supremacy of commerce, Germany was involved in mighty continental disturbances, of which the 30 years' war, which reduced the population from 25 millions to 12 millions, threw the country into exhaustion and internal disorder, and it took all the time till the reign of the Emperor William I. to strengthen the shattered race and reunite the Empire. With a population of 30 millions, as Germany had in the year 1830, it was quite rational, to be principally an agrarian country, the competition in North American and British-Colonial agricultural products not yet existing. But the German population having now risen to 54 millions, with a yearly increase of 670,000 inhabitants, and after American and British-Colonial products have ruined German agriculture, the law of self-preservation has forced Germany, *nolens volens*, to cease being an agricultural country, but to enter the rank and file of industrial competitors, which, in due course, and in strict accordance with the Chamberlain dogma, led Germany to colonial and sea power. Thus, German increase of population, North American and British agricultural competition forced Germany to become a competitor of industrial, commercial, and colonial England. No light-handed grumbling about imagined interferences with rights, which have no legal standing, nor any amount of national outburst of bad temper could change the logical sequences of Nature's laws. There are only two alternatives for England to meet the altered state of things, viz., either to destroy by force of arms half of the German population, its industry and commerce, and thus to reduce the empire to its former state of under-population and disorder; or, to accept the altered state of international position, and to undertake, shoulder to shoulder with Germany and with all other competing nations, the peaceful development of civilisation and culture of industry and commerce. Fortunately there is still plenty of room for all of us in many foreign lands! Although Germany is fully prepared for any attempt in the direction of the first alternative, everybody in the country is most heartily wishing for the latter, and the sooner such also becomes recognised in England the better for general peace, and for the welfare of the world.

Only a few words more about the fallacy of chauvinistic literature. Your correspondent suggested to the head of the German Empire, "to purchase for a few marks some patent or other from one of his *starving subjects*," evidently endeavouring, and perhaps succeeding, to make his countrymen believe that German industry and trade are in a starving condition.

Now, then, sir, as starvation and emigration always go side by side, let us look at the figures of emigration in Germany and in England. As long as Germany was principally an agrarian state, the annual emigration reached a few hundred thousand; thus the year 1882 still showed 220,902 German emigrants. From that year, and hand in hand with the development of German industry and commerce, the emigration gradually dwindled down, till it reached, in the year 1896, the insignificant figure of 33,824; and this in spite of an increase of population of 6,944,000 during that period of 14 years. The statistics of English emigration, on the other hand, show quite a different picture. England, including Scotland and Ireland, with a much smaller population than Germany, always showed a larger emigration, which amounted to a yearly average of 256,726 persons during the eightieth years, and rather increased during the later period, showing 271,772 emigrants during the year 1895. I leave it to the judgment of the impartial reader on which side starvation is most likely to be; anyhow, it does not seem to be on the German side.

Hoping that these lines might contribute somehow to a better mutual understanding with regard to the inflexible laws of international and political economy and to smoothing existing friction.

R. von Fischer-Treuenfeld.

Dresden, *December 28th*, 1897.

Dust Destructors.

Mr. Raworth's letter on the subject of the Shoreditch Dust Destructors is opportune, as hitherto there has not been

much point in the arguments advanced. But he fails entirely to appreciate the question, which, to those of us who are looking on, is at issue in this connection. We are not wanting simply to be told that, providing the extra capital expenditure does not exceed a limit, a combined dust destruction and electric lighting station is an economical undertaking. This we can pre-determine with fair accuracy for ourselves.

What we *do* want to know is the actual practical value of the method of thermal storage in use? This, for us, is what is under trial at the Shoreditch station. Mr. Raworth's diagrams and arguments ignore this question of storage altogether; and, therefore, although by contrast so clearly and vigorously expressed, they are really beside the question.

Is the thermal storage effective for the purpose for which it was designed? The fact that some coal is already necessary, although the station is but lightly loaded electrically, while supplied with its full quota of refuse, in the absence of other information, affords reasonable excuse for doubt that it is. Either the storage capacity is too small, or the practical thermal efficiency of the plant is extremely low. Imagine balance-sheets of two instances, the one as at Shoreditch, the other similar in every respect, except that the thermal storage paraphernalia is absent. On the debit sides are the total calorific values of all the available refuse of the parish, and that of certain quantities of coal; on the credit sides are the electrical outputs. Question: would the Shoreditch balance-sheet show any substantial advantage over the other? and if so, is it sufficient to justify the extra capital charges incurred on the storage plant?

Now, it is scarcely reasonable to expect Mr. Kershaw to decide technical points of this nature; rather it is for the designers and contractors to take up the challenge that has been thrown down, and to give figures to show that the innovations they have introduced have proved a success. If they can it is in their interest to do so; but are they not very agreeably surprised by the somewhat mistaken view of the Shoreditch scheme that has been taken by the public in general, and Lord Kelvin in particular?

It must not be forgotten that Shoreditch is not the first district in which the heat of dust destruction has been utilised for the purposes of electrical supply. It is simply the first of such undertakings in which thermal storage has been attempted.

It is very clear, nowadays, that unless some really effective system of storage can be devised, the advantages derivable from the combination of these essentially antagonistic processes of dust destruction and electricity generation, cannot be of attractive dimensions, and they have an unpleasant habit of vanishing altogether when put to the practical test. There are several methods of storage, the three most direct and obvious are:—

1. Storage of refuse, and the provision of means by which it can be burnt at any desired rate.
2. Storage of heat.
3. Storage of electricity.

Two years ago the Battersea Vestry invited schemes for the utilisation of the waste heat of their dust destructors in connection with electric lighting. As one of the competitors, I proposed a rather fanciful system of storing the heat, by means of regenerative stoves of brickwork. As an alternative, I outlined a scheme of refuse storage, in which I have still much faith. The time allowed for this competition was much too short, otherwise it might have been productive of some useful and interesting proposals.

The third method, storage of electricity, is rather under a cloud, because of the poor results at St. Pancras. But has it had a fair trial? Its great advantage is the way it economises boilers and generating plant, and in this way it partially balances the extra capital expended on the batteries. I am much inclined to prophesy that eventually the Shoreditch plant will be worked wholly on this method.

James Whitcher, A.Inst.E.E.

January 1st.

New Thermal Ampere-meter.

Referring to a note in your last issue on a new thermal ampere-meter, the following remarks may be of some interest:—

Many years ago, in 1881 and 1882, I experimented with several forms of instrument on much the same principle as that described in your note. In some, the bulb of an ordinary thermometer was closely surrounded by a conductor heated by the current to be measured, in others the bulb was forked, and the current, or a derivation from it, passed up one leg and down the other.

The object was to provide a means of measurement for alternating currents. A sliding scale, calibrated by means of continuous currents, was used, the zero of the scale being made to correspond with the height of the thermometer before the current was applied. Several of these instruments were useful at the time, but I did not consider them as practical for ordinary use, partly as being very delicate and of limited range, but chiefly because their indications depended, to some extent, on the conditions as regards the radiation and convection of heat from them.

I therefore much preferred the principle of the voltmeter, which has since become well known, in which the wire heated by the current is entirely enclosed within a thin tube of an equal coefficient of expansion to which the wire is fixed, so that the expansion measured is not absolute, but relative to the enclosing tube, to which all the heat generated in the wire must pass.

Thus the instrument reads the difference of temperature between the wire and the tube. I consider this principle very important for accuracy in any instrument depending upon the expansion of a conductor heated by an electric current.

P. Cardew.

January 3rd, 1898.

Localising Faults in Submarine Cables.

The following, read in conjunction with Mr. H. C. Cann's communication, published in your issue of December 18th, 1896, may prove of use to some of your readers.

Modification of the Kennelly break test:—

The battery to be grouped in certain determined ratios, such as 1—2—4, or 1—4—16; if the former, we shall have from the rule of inverse square roots the resistance of the exposed end, as 1, 0·696, 0·485.

Measurements to cable current zero, and zinc to line. When measuring with the intermediate and lowest powers, insert in the battery circuit a resistance equivalent to the difference between the internal resistance of the cells in use, and that of the total, or greatest number; then it will be found that $X = A - 4{\cdot}75\ (B-C)$.

The measurements, A, B, C, as usual, A being that obtained with the lowest power. For breaks close to the observer, the above will be found to give excellent results.

A few examples.

Break at 10 ohms distant.

Grouping of cells, 16—8—4. I.R. of battery 48 ohms.

100/100 zinc to line, measurements to cable current zero:—

C = 25 ohms.
B = 33 ohms (24 added to battery cct.)
A = 48 ohms (36 „ „)
∴ X = A—4·75 (B—C) = 48—38 = 10 ohms.

Ditto at 20 ohms.

C = 35
B = 43 (add as above).
A = 57 („ „) X = 57—38 = 19 ohms.

Ditto at 30 ohms.

C = 44
B = 52 (add as above)
A = 69 („ „) X = 69—38 = 31 ohms.

Ditto at 40 ohms.

C = 55
B = 63 (add as above)
A = 78 („ „) X = 78—38 = 40 ohms.

Ditto at 50 ohms.

C = 67
B = 75 (add as above)
A = 90 („ „) X = 90—38 = 52 ohms.

Break at 80 ohms.

C = 96
B = 105 (24 added to battery cct.)
A = 123 („ „)
X = 123—42·75 = 80·25 ohms.

D

Ditto at 100 ohms.

C = 117
B = 125 (added as above).
A = 138 (" ")
X = 138—38 = 100 ohms.

Ditto at 150 ohms.

C = 170
B = 180 (added as above).
A = 197 (" ")
X = 197—47·5 = 149·5 ohms.

Ditto at 500 ohms.

C = 522
B = 235 (added as above).
A = 562 (" ")
X = 562—61·75 = 500·25 ohms.

Ditto at 1,000 ohms.

C = 1,050
B = 1,070 X = 1,100—95 = 1,005 ohms.
A = 1,100

Break at 20 ohms.
Another set, bridge 100/10. I.R. 44 ohms.

C = 273
B = 302 (add to battery cct. 22 ohms)
A = 350 (" " " 35 ")
X = 350 — 137·75 = 212·25 = 21·22 ohms.

Break at 45 ohms. 100/100.

C = 53
B = 62 (add as above)
A = 72 (" ")
X = 72 — 28·5 = 43·5 ohms.

Ditto. ditto. 100/10.

C = 534
B = 568 (add as above)
A = 638 (" ")
X = 638 — 161·5 = 476·5 = 47·65 ohms.

Break at 20 ohms.
I.R. 16 minottos = 162 ohms. Bridge 100/10.

C = 365
B = 450 (added to battery cct. 81 ohms)
A 590 (" " " 120 ")
X = 590 – 4·75 (450 – 365) = 18·6 ohms.

Break at 500 ohms.

C = 5,250
B = 5,380 (added as above)
A = 5,580 (" ")
X = 5,580—4·75 (5,380 – 5,250) = 496·2 ohms.

John McGill.

Alexandria, Egypt, *December 22nd*, 1897.

Shoreditch and its Dust Destructor.

My attention having been called to the letter in your last week's issue signed "Power," and having also read the two letters in this week's issue signed by Mr. Raworth and Mr. F. W. Brookman—although, as I have already stated, it was not my intention to continue a newspaper correspondence with anonymous letter writers—I feel that, as the two letters in this week's issue are signed by gentlemen who show their *bonâ fides* by writing over their own names, I must, in courtesy, reply, as far as I am able, to the position of the Shoreditch destructor as they put it.

I must thank Mr. Raworth, whose acquaintance I have not had the pleasure of making, for his very lucid letter, which shows that, in contradistinction to your anonymous correspondents, he has at least grasped the reasons that have induced the Shoreditch Vestry to embark on this undertaking, and realises the certainty of their making some profit out of the combination which must, at least, be worth the having, whilst it may result in savings of a most considerable nature.

Referring to the remarks that appear over the *nom de plume* of "Power" once again, and to the general tone of the correspondence of this gentleman, "X. Y. Z.," and "Anti-Humbug," and likewise to the position you yourselves have thought fit to assume in this matter, I wish to protest in the most emphatic manner against the false impressions that are being disseminated amongst those who may be interested in adopting such a combination as we have, and who are more than likely to assume by you and your unknown correspondents' attitude that the allegations of deception and fraud so constantly reiterated by you and your anonymous friends must of necessity have some justifications in fact.

My Vestry have entered upon an experiment which they were led to believe would save them in the expense both of the disposing of their ash-bin refuse and in the production of electricity for the supply of their parish, and if these two hopes are realised, as they bid fair to, then they will have achieved all they hoped to do.

As you are well aware, quite recently attempts have been made in two London districts to effect the same object, with signal failure in both cases. By this I mean that in neither case has the refuse destructor been of any practical use in the generation of electricity in the electric light stations erected in proximity to these two dust destructors.

As I have constantly reiterated, so far the electricity supply in Shoreditch has been maintained by the combustion of the refuse, only excepting on those occasions when there has been no refuse to burn; and every fair-minded man holding unprejudiced views cannot but admit that the efforts of my Vestry have already resulted in turning into a not inconsiderable success that which has been attempted previously by others without success, and therefore some credit is due to us and our engineers for a pioneer effort in the direction of the utilisation of a waste product, even though it may be possible that in the future plant may be designed which may give better results than the first successful combination of the kind.

To read your own remarks and those of your anonymous correspondents, one would almost imagine that your journal had changed hands and is now being controlled by some journal having antagonistic interests to the advancement of electrical industries. I should myself have thought that your journal would have been the first to have congratulated us on the undoubted success we have met with, instead of doing all in your power and in that of your anonymous correspondents to make it appear that not only is the undertaking not a success, but that fraudulent means have been adopted to make it appear so.

I note, indeed, that you say "And if the first twelve months' work show that their combined scheme of dust destruction and electricity is successful we shall be the first to acknowledge it." Would it not have been fairer and in every respect more desirable—assuming you really had any desire to see the success of an electrical scheme, such as this, involving substantial progress—if you had left your remarks unsaid until such time as the works publish their first accounts, and then, and then only, used the influence and power of your journal to criticise it unfavourably, if it so deserved, than to endeavour to hound it down at this moment so as to discredit it in the eyes of others, who must undoubtedly be influenced by the erroneous view you take of the matter, and who, unfortunately, are hardly likely to notice those few words in which you may in the future acknowledge that you were mistaken in your previous impressions so continuously and emphatically reiterated in your paper from week to week by the shamefaced utterances of anonymous correspondents?

As an example of the way in which you and your correspondents endeavour to turn an easily explainable fact into a proof of the justness of your and their remarks, one cannot do better than read that portion of "Power's" letter in your issue of last week, in which he refers to the letter of the "Engineer in charge of the Dust Destructor, Shoreditch," to the *City Press* of August 11th, stating that "It is the fact that coal was used on the opening day, but that because we had no refuse, and therefore had to burn coal to generate the steam required," and in reference to which "Power" goes on to state that Lord Kelvin said dust only was used, while the engineer says that they had no refuse, but burnt coal to generate the steam, and that therefore Lord Kelvin was not in the coal secret, and ending up by inferring that a lie was told the assembled company in stating that the current was generated from dust, and dust only.

Now, Mr. Editor, what were the facts. The current during the morning and the afternoon was generated entirely by ash-bin refuse as stated, and would have continued to have been generated by ash-bin refuse throughout the night, had it not been that the Vestry had a parade of their dust carts in connection with the opening ceremony, as you yourself must have seen when you were there, and which naturally resulted in the dustmen not collecting any further refuse

that day after the early morning, and as we have not yet solved the problem of raising steam without either refuse or coal, we were under the necessity of continuing with coal, when the refuse was completely burnt out, for the rest of that evening.

Referring now to Mr. Brookman's letter, I would again point out to you the damage that is occasioned by you and your anonymous correspondents' erroneous expressions, as is exemplified therein, for Mr. Brookman, who writes most fairly on the subject, states in his letter "As to anyone being ashamed of Shoreditch, I give the chairman credit for having done his best, and no one can do more, and that being so there is no need for shame, even if the scheme was an absolute failure, which cannot be said of Shoreditch *I think*." From which it is evident that he too has been misled by you into believing that there is certainly a taint of failure about the Shoreditch scheme, for he evidently is not quite sure but that it may possibly be a complete failure.

The destructor works being still under the guarantee of the contractors for this portion of the work, it is impossible for me, without violating my position as chairman of the Electric Light Committee, to give Mr. Brookman such answers to his questions as might place the Vestry in a false position with their contractors, especially seeing that Mr. Brookman, at the time when the contract for the said works was being settled, approached the Vestry as representing or assisting one of the competing contractors who did not obtain the work, and I would, therefore, ask him to wait for an answer to most of his questions until we are able to answer them authoritatively without prejudice to the contract, and would further point out to him that the total number of units sold as against the actual refuse burnt, could convey no conclusions to his mind, since the number of units that was sold from the combustion of that amount of refuse, although very considerable, does not represent the number of units that could be sold from the combustion of this amount of refuse, if the output demanded a further supply. I can, however, answer his question as to the size of the accumulator battery we have installed. It is only proportioned to give an output of 25 kw. during the hours of maximum load, and is therefore not a material help at that time, but is rather intended to provide an unfailing source of current whence to magnetise the fields of the various generators.

I therefore ask Mr. Brookman, and all the many readers of your Journal who may have been misled by the misstatements you and your anonymous correspondents have so consistently made, and which I am powerless to contradict while the matter remains still *sub judice*, to wait until that time when our first year's running accounts are published, as they will doubtless all perceive that the proof of the pudding is in the eating, and not in the interested remarks of anonymous correspondents (competing dust destructor manufacturers, coal merchants, dust removal contractors, &c.), or the opinions of editors of journals, who have no practical experience of the subjects about which they write.

H. E. Kershaw.

129, Curtain Road,
Shoreditch, *January 3rd*, 1898.

[We must protest strongly against Mr. Kershaw's allegations that we have suggested, or even hinted at, there being deception and fraud going on at Shoreditch, and we much prefer that in future he should deal with our comments separately and not recklessly mix them with what our correspondents, who are well able to take care of themselves, have said. Our own remarks were based solely upon Mr. Kershaw's official statement as chairman of the Electricity Committee, and it seems to us that this worthy gentleman himself would have been better advised had *he* refrained from giving figures until the works' accounts were out, unless he were content that they should be criticised. It is important to observe that though Mr. Kershaw has given certain "official figures" regarding the dust destructors, he objects to give more on account of "the destructor works being still under the guarantee of the contractors." As to the few words at the end of our amiable correspondent's letter, we are content to rest in the knowledge that he is not in a position to judge.—Eds. Elec. Rev.]

THE ENGINEERS' STRIKE.

When the late Conference was proposed, the men's executive professed themselves most anxious to hold it, and the Employers' Federation came in for a good deal of abuse for not running hastily to it. It was generally understood that the two sides at the Conference would come to certain agreements which would be endorsed by their respective supporters. On the side of the men, however, while agreeing to things at the Conference, their representatives have practically told the men not to endorse their action. Below we print a statement of Col. Dyer's, made on behalf of the Employers' Federation:—

"The conditions of freedom to the employers in the management of their works, which was one of the subjects before the recent Conference, are not merely proposals of the employers, but were agreed to by the representatives of the allied unions, who introduced some modifications of the original terms to safeguard the position of the unions. It is also highly significant that the leaders of the allied trades offered that their men would return to work on the following Monday under these conditions of management, provided the employers would agree to a 51 hours' week.

"This offer conclusively proves that these conditions are not in any way incompatible with the proper functions of trade unions. The federated employers have resolved to adhere to them in future. The federated employers have repeatedly declared that they cannot agree to any reduction of hours, and nothing has occurred to alter their decision. No prolongation of the dispute can, therefore, affect their position with regard to the conditions of freedom in the management of their works and the hours of labour.

"Under these circumstances, the federated employers invite the serious attention of the workmen concerned to the fact that these conditions of management will afford an opportunity to the individual workmen to earn much higher wages, that any man desiring to improve his position will have opportunities of acquiring greater skill, and that every man will have the right to bring any grievances to the direct notice of his employer, either individually or through his union. It does not appear that these advantages were brought before the notice of the workmen, nor that it was pointed out to them that there is no intention of imposing novel conditions, or of reducing the rates of wages paid to skilled men; but that the freedom which the workmen enjoy in many of the federated workshops is to be extended to all of them.

"The Federation hope that the time is not far distant when the workmen will appreciate the goodwill of their employers, and will frankly accept the situation by withdrawing their demands for a diminution of the working hours, and by accepting the conditions of management agreed upon at the Westminster Conference, which closed on December 17th.

"(Signed) Henry C. S. Dyer, President."

We would draw special attention to the fact that the conditions as to non-interference were agreed to, and that this is not considered incompatible with trade union interests. The hours question is thus alone nominally standing in the way.

At the time of writing, December 31st, there is in the immediate future the alternate prospect of a spread of the lockout, which, indeed, has, we believe, already taken place by the posting of the hitherto Conference delayed notices, or of the opening of their works to such of the men as choose to return to work on the basis of the agreement come to at the Conference. We hope this latter course will be the one adopted. It would show the employers determination to adhere to the terms they had agreed to, and it would enable many men to return to work who are anxious to do so. The strike will go on, we suppose, all the same. It will become a sort of academic institution. Like some of the City Guilds which have long since lost all touch with the originating cause, the strike may continue drawing funds from America and Germany for an indefinite period. But that, as a practical fact, the strike will go on, we hardly believe. It was bound to fail, being started on a false basis. By Mr. Barnes's own confession, the quarrel was shunted from interference with shop management and the machine question, to the "popular one of the eight hours' day," and the trick failed to gull the public at large.

That curious body, the Fabian Society, compounded of snuff-clothed dramatic critics and æsthetic dames with its pseudo socialism and general dilettantism, has at this late hour given mouth on the question in the shape of a manifesto in favour of the strikers, gratuitously and ignorantly assuming that the desire of employers to use machinery is merely an attempt to reduce a prosperous trade to the level of a sweated one, where collective bargaining has not yet been introduced. Absolute ignorance is all we can say to such drivel. There is no desire to interfere with the proper duties of trades unionism, nor would there have been any move in the direction of complaint about the minimum wage had the A.S.E. done its duty, and seen to it that its members for whom it asked a minimum wage were all competent men. But everyone knows that large numbers of the A.S.E. are not good men. It is a blunder on the part of the A.S.E, for which history will record its sentence, to have allowed itself to be dragged out of its proper path. But the powerful desire to get up a fight has been the dominating factor; funds must be raked in, and men who have had no claims to be called engineers, have been admitted to membership for the sake of funds. It is not trades unionism that is at stake in any sense. It is simply the policy of Barnes or of those who have pushed Barnes into the van, that is now being tried and found wanting. This is the vampire that has sucked the vitals of unionism, and through unionism of English trade. All suffer by it, from Col. Dyer to the last new apprentice.

We confess to sharing the doubts recently expressed in an able article in *Engineering* that much of the freedom allowed for in the

sounding clauses agreed to at the Conference amounts to really nothing. Freedom to employ any man is one of these; freedom to be a trades unionist is another. According as a shop falls under the head of union or non-union, so far will certain unwritten laws tend to prevail. The whole thing is a matter of common sense and the application of knowledge of facts. If men would do a fair day's work, their nursing by the trades union would do no harm. Probably the average workman needs some such backset. But he is unfortunately ordered by his executive to do certain things in the way of loafing which he is told are for his good. He has done as he was told, and has simply succeeded in proving to the world that apprentices and labourers can turn out more work than he has been doing. But this is not trade unionism. It is want of knowledge. If the secretary of the A.S.E. had been a man of better education and of observant travelled experience and with a knowledge of commercial facts, he would have carried on the business of the A.S.E. in a very different manner, and would have succeeded in getting for his members better pay. We fancy we see Col. Dyer receiving a notice some morning that "he is paying his men too little, and compelling them to the monotony of attending to two machines while capable and desirous of having three." This is the sort of thing a really live and up-to-date secretary of the A.S.E. would see to. But we cannot learn that there has ever been anything but restriction; we cannot hear that there has been for many years the slightest attempt to secure that its members were ordinary decent tradesmen and reputable citizens. We do not learn that they have ever taken cognisance of any complaint made against their members for notorious laziness. We hear of no single case of any willingness to render possible the taking of some big contract by agreeing to the *status quo* of wages pending its completion, or of any case of a willingness to work with an employer for the common good. One thing is very certain. Machinery in the end is bound to win. This does not imply that the human workers will lose, or how is it that in the chain trade, to which machinery is so little applicable, the human element is so badly paid? Machinery will win and the skilled tradesman—the fitter—will be so scarce in time that when needed he will command good pay. Skill will consist in an ability to compel so many machines to do so much work, and the old seven years or five years apprenticeships will die out. A machine can be learned quickly. Boys will earn more than they did, and the family man will be sooner relieved of his expenses. The fact has got to be faced. The whole system has got to be changed, and it is scarcely likely that the country will go out of trade to suit minds of the quality Mr. Barnes seems to consider as above the average, to wit, his own (*vide* speech at Enfield). Failing to secure the modern methods forced on her by foreign competition, England will have to go out of trade, but England has no intention of going out of business, and the sooner this fact is realised the better it will be for all who are pursuing an *ignis fatuus*. Workmen have so often claimed that all wealth is the outcome of labour that one marvels to see them demanding conditions that could only be granted them if wealth were other than the product of labour. But the mere manual labourer, working by the strength of his muscles, or with the experienced collaboration of hand and eye, would never produce a fraction of the wealth he is able to produce in conjunction with the brain worker, and the brain worker is entitled to some of the wealth he helps to produce. The present demands of the manual worker amount to a claim by him that he is competent to perform both the manual and the brain work, for if the performance of a machine is to be restrained at the desire of the labourer, why not the whole system of book-keeping, supply, purchase, sales, and finance. If we go to the full end of this line of argument we should find ourselves compelled to place the general-managership of all England in the hands of the coal hewers, who alone are at the root of all power. The A.S.E. are very keen to grasp the duties of those above them, but they are jealous to a fault when those below them, or even on a par with them, interfere with their privileges or encroach upon fields they consider to be their own. Labour can only be turned to wealth by the touch of management, and to interfere with management will be fatal to success. Management may not always be successful. When otherwise it brings its own punishment very quickly. To force trades union ideas of restriction upon management would ruin everything. If it be good to work any machine below its capacity, then must it be good to work it not at all, or at least to build cheaper machines good enough only for the reduced capacity. Backwardation of this stamp would quickly bring us back to the time of no machinery. Trades unionists would not acknowledge that this is what they are aiming at, but if they do not it is because they have not sufficient perspicacity to see to the end of the lane they are following. Neither do they seem to perceive that in stopping production they are reducing the power of the nation to pay them wages. England without work would be a sorry place to live in until the production of its own soil was equal to the demands of its population. It is fortunate that the number of men now idle bears so small a ratio to those at work, and we might remind trades unionists that the other business of the country, when it wants the production of engineers, will not come to a stop because such productions are not to be had of English make. They will simply purchase them from abroad.

In view of what he considers the failure of Unionism, Mr. Tom Mann now proposes that Unionism should be national, and provide its members with simply idle pay, strike pay and funeral expenses, but the old, infirm, or sick will have no claim. Practically, Mr. Mann's proposals amount to the recruiting of a mere fighting army which will bury its dead We do not think that he will find many decent workmen to join his new army. That there is something wrong with Unionism we admit with Mr. Mann himself, but we cannot but smile when Mann says so. It is calm in the very eye of a cyclone, the apparent *fons et origo malis*. Looked on as a cyclonic movement, trades unionism is equally calm in its centre of disturbance, but Mr. Mann is not on strike pay. He can be calm, but he is now feeling anxious for the men to get back to work, for if they are idle much longer, where are the funds to come from wherewith poor Tom struggles so bravely along?

On Friday last the Fairfield Company of Govan posted lock-out notices, which will affect about a thousand members of the A.S.E. The Fairfield Company seems only to have come into line because they are persuaded of the necessity of doing so, for they have stood out of the Federation a long time.

It is reported from Yarrow's Yard that cylinders are now being bored out in three days less time than before the strike. The secretary of the Free Labour Association states that the Association has provided 22,000 men during the strike, of whom no fewer than 8,500 are at work in London alone. We are sorry to learn that the Free Labour Association refuse to entertain men who have been members of the A.S.E. who wish to leave the A.S.E. and get back to work. There must be many who wish to do this, and it is pitiable to think of the straits to which these men and their families are reduced by the long idleness.

The engineering employers of Leeds are responsible for the following statements as to the conditions prevailing in Belgium, where the hours of labour range from 60 to 66 per week.

In Liege, the wages for 60 hours per week for fitters are 18s. 4d. to 22s. 6d.; turners, 18s. 4d. to 28s. 9d.; machinemen, 13s. 9d. to 18s. 4d. At Antwerp, the wages are:—Fitters, 21s. 3d. to 26s. 3d.; turners, 21s. 3d. to 26s. 3d.; machinemen, 18s 4d. to 18s. 9d. *Overtime counts after* 12 *hours.* The Clyde wages for 54 hours are for fitters, turners, and machinemen, from 25s. to 35s.

English workmen should endeavour to bring up the European Continent to English levels. Comparing foreign with English wages, it is not possible to urge that the foreigner puts up with less money because his living expenses are less, for it costs more to live there than in England, the purchasing power of money being much more in England than it is abroad.

It is undesirable that English wages should be reduced. Reduced wages only mean a smaller volume of home trade. The endeavour should be to increase the output of the country. It is only by output that England can live, but one has only to refer to the case of Thomas Parker, Limited, reported on page 933 of our last issue, to see how output is deliberately curtailed by unprincipled unionists.

The Trades Union Congress of Saturday last does not help to clear the atmosphere. Confusion of issues is more confounded than ever. Mr. Barnes, who has agreed to certain things at the Conference, and offered to send the men back to work if the 51 hours' week was accepted by the employers, loudly states that the men will fight on until 48 hours is won. But men outside the A.S.E., who spoke at the Congress of Saturday, stigmatise the terms of the employers as ridiculous, and as an attempt to destroy trades unionism altogether. Yet Messrs. Sellicks and Barnes agreed to these very terms. Indeed, here is an abstract of their circular to the men:—

"These proposals differ somewhat from those submitted before, and they secure the status of the unions on some of the points covered. . . . . The right of the unions to collective bargaining on behalf of their members is maintained. . . . . On the whole the proposals, as set out, do, to some extent, risk your interests, but your delegates ventured to offer on your behalf a return to work on the basis of a 51 hours' week, which, however, the employers declined."

Clearly if the employers had only acceded to a 51 hours' week, the risk hinted at would have been taken. Clearly a matter of three hours a week cannot make all the difference between smashing and preserving the principles of unionism. On the other hand, it may be argued that the employers, on their side, are not merely concerned with the demand for eight hours. If it had not been for the trades unions themselves, and their restrictions on output, we should have had the eight hours long ago. The employers undoubtedly are fighting for the right to run their machinery under its best and most economical conditions. They object to the eight hours because they want to be first very sure they have got the upper hand in the output question before they risk curtailment of hours. Neither the men nor the masters are really so interested in the hours question as they themselves believe. As regards the men, such of these in London as are in eight-hour shops still come up from their suburban homes by the same trains as formerly. If offered to start work at 8 a.m. only, and with one break per day, they will grumble because they must still come early to save the workman's trains. The employers do not really care so much about the eight hours, and are really fighting for infinitely more than the few hours. From 9 to 8 hours is only about 12½ per cent; but between the A.S.E. loafing rates and cuts and decent work there is anything from 25 to 400 per cent. Of what concern is a paltry six hours in comparison with this? Mr. Barnes at the congress made the usual charges against the employers as the cause of all the suffering, and as disturbers of the peace. Knowing that the lockout would follow on the strike for eight hours, one can only, in a sense, admire the brass of the man who can so deliberately travesty facts. There was a good deal of discord at the congress, and it is curious to note that the money to be collected by the suggested weekly levy on all unionists is to be distributed by the Parliamentary Committee, not by the A.S.E. It seems clear that the A.S.E. is out of favour, the general body of trades unionists resenting the autocratic behaviour of that section. The above 3d. levy was estimated to produce £12,000 a week, which is more than Mr. Barnes asked for. But there seems a doubt as to its forthcoming. He referred to the men having been existing for six months on 7s. to 16s. a week. "God only knew how they did it." Mr. Barnes, if he has the strength of mind to cut down his own diet below the scale of the Westminster Palace Hotel, might try it on for himself for a month. He would learn, then, how they did it, and in the future he would, perhaps, be a little more careful how he led his fellow men into such positions.

Mr. Barnes talks too much by far. His policy is not trusted by other unionists, and is, there seems but little doubt, responsible for the sad condition of the engineers to-day. His speeches teem

with contradictions, and are strangely out of agreement with each other. Having shunted the dispute once to the popular issue of hours, he does not find this to work, so he has tried to shunt on to an attack upon unionism. But his own friends have found him out, and we scarcely think that the A.S.E. is going to get its further funds for fighting, unless it be from Germany or America.

BUSINESS NOTICES, &c.

Electrical Wares Exported.

WEEK ENDING JAN. 4TH, 1897.

	£	s.
Bombay	32	0
Buenos Ayres	30	0
Calcutta	473	0
Cape Town	149	0
Durban	272	0
East London	2,130	0
Flushing	80	0
Melbourne	189	0
,, Teleph. mat.	45	0
Sydney	213	0
Total	£3,613	0

WEEK ENDING JAN. 4TH, 1898.

	£	s.
Alexandria. Teleph. mat.	109	0
,, Teleg. mat.	34	0
Albany	38	0
Amsterdam	85	0
Antwerp	65	0
,, Electric fuse	410	0
Auckland	20	0
Bangkok	35	0
Barcelona	15	0
Bermuda. Teleg. cable	95,000	0
Bombay	41	0
Bordeaux	20	0
Borneo	1,206	0
Brussels	396	0
Calcutta...	313	0
Cape Town	1,095	0
Colombo	36	0
Copenhagen	96	0
,, Teleg. mat.	54	0
Delagoa Bay	36	0
Demerara	135	0
Durban	506	0
East London	822	0
Gibraltar	24	0
Gothenburg	24	0
Halifax. Teleg. mat. ...	18	0
Hamburg	33	0
Jamaica. Teleg. mat....	174	0
Kurrachee	150	0
Lyttleton	408	0
Melbourne	52	0
Montreal	30	0
New York	10	0
North Atlantic. 3,000 lbs. Teleg. cable	—	
Ostend	85	0
Port Said	101	0
Rio Janeiro	10	0
Rotterdam	33	0
Stockholm. Teleg. mat.	24	0
Sydney	1,186	0
,, Teleg. mat. ...	133	0
Turk's Island. Teleg. mat.	15	0
Vera Cruz	69	0
Wellington	83	0
Yokohama	576	0
Total	£103,956	0

Foreign Goods Transhipped.

	£	s.
Christiana	84	0

Additional Premises.—Owing to the increased business, Mr. F. C. Allsop has had to take large new additional premises at 126, Queen Victoria Street.

Business Announcement.—Messrs. Handley & Shanks have opened new offices and showrooms at 12, Dawson Street, Dublin. Mr. Arthur Handley, A.I.E.E., will act as manager for Dublin and neighbourhood. The firm undertakes all classes of electrical work, including town and private lighting, and transmission of power. They are carrying out important contracts for the principal railway companies in Ireland.

Calendars, &c.—Messrs. W. H. Willcox & Co., send us an 1898 Date Remembrancer, having a detachable sheet for each month.

We have also received, as usual, one of the E.P.S. Company's very useful blotting pads, with almanack for 1898, memoranda book, &c., attached, and some general information regarding the company's batteries. We believe there are many electrical men who, like ourselves, find these pads very serviceable.

Messrs. Hazel, Watson & Viney are sending out the seventeenth edition of the Hardware Trade Diary and Cash Book to the subscribers to the *Hardware Trade Journal*, in accordance with usual custom. This volume, we have no doubt, is welcomed by that class of business men for which it is intended, and particularly to those having to make a good number of cash entries every day. The book is ruled cash throughout, with the exception of a few memoranda pages, and there is half a page set apart for each day. All the pages are interleaved with blotting paper.

The Brockie-Pell Arc Lamp Company send out a handy pocket-card, with revolving arrangement, by means of which dates for any day up to 1903 may be ascertained.

Messrs. Jackson & Coleby, electrical engineers, of Thayer Street, W., have issued an 1898 calendar with a sheet for each month.

Messrs. Hodges & Todd, of Hampstead Road, N.W., have brought out a very neat and well printed calendar. There is a sheet for each month, and each sheet has a complete calendar for the year. This firm reports with regard to the business of last year that, notwithstanding the serious labour troubles, they have had a very successful year. Their trade in large switchboard and central station requirements has been quite unprecedented, whilst the demand for ammeters and voltmeters, together with their specialities in high tension apparatus, has been far ahead of previous years. During the year they have extended operations by opening premises in George Street, and cabinet works in Seaton Street, to cope with the large increase of trade.

Catalogue.—Messrs. W. M. Still & Co., of Charles Street, Hatton Garden, have compiled a new catalogue. Among a host of general brass and copper fittings for a variety of purposes, we observe stamped ornamental switch bases, or feet, for floor lamps, brass and copper art fittings, electric globe carriers, counterweights and pulleys, reflectors, switch covers, bell pushes, and numerous electrical accessories. There are further various artistic designs of coronets for arc lamps, the Still incandescent lamp, &c. The catalogue, which contains over 150 pages, and is well studded with illustrations, is bound in stiff green covers.

Changes of Address.—Mr. A. A. Crawford (The Bombay Electric Company), of Bombay, announces that owing to increased business, he has taken more extensive business premises at No. 9, Meadow Street, Bombay, where letters should now be addressed. The workshops are also being extended.

Owing to 19, Great George Street being required for the site of the New Government Offices, Edmundson's Electricity Corporation, Limited, have removed their offices to Broad Sanctuary Chambers, Westminster.

Messrs. Handcock & Dykes are removing from 5, Victoria Street, S.W., on January 29th, to Westminster Chambers, 1, Victoria Street, S.W.

Dissolution of Partnerships.—Messrs. Henry Lea and W. H. Thornbery, carrying on business as consulting engineers at Bennett's Hill, Birmingham, as Henry Lea & Thornbery, have dissolved partnership. The business will be continued by Mr. Henry Lea and his son, Mr. F. M. Lea, under the style of Henry Lea & Son. See our "Official Notices" for further particulars.

Messrs. C. F. Slater, S. R. Slater, and F. Crossley, manufacturers of surgical appliances and electrical apparatus, and manufacturing electricians, of 20, Baker Street, Portman Square, trading as Slater, Bros. & Crossley, have dissolved partnership. Debts will be attended to by C. F. & S. R. Slater.

Liquidation Notices.—A general meeting of the Acme and Immisch Electric Works, Limited, will be held on February 4th, at 3 o'clock, for receiving an account of the winding up from the liquidators, Messrs. E. Wilding and J. Gray.

Partnership Notice.—We are informed that Messrs. S. V. Clirehugh & F. A. Cortez Leigh have entered into partnership with Mr. E. M. Lacey, A.M.Inst.C.E., and Mr. A. M. Sillar, M.Inst.E.E. The title of the firm will now be Lacey, Clirehugh & Sillar, and the offices will henceforth be situated at 78, King Street, Manchester, and at 10, Delahay Street, Westminster. Each partner will, as heretofore, give personal attention to the work on which he is at present engaged. The notice we have received does not make it quite clear whether Mr. Cortez Leigh is included in the arrangement. His name is printed at the top of the printed circular, so we assume he is a partner.

Change of Name.—We are asked to state that the name of the firm of Venner & Sillar, of Delahay Street, has been changed to Venner & Co.

Electrical and General Engineering Company.—This company informs us that the electric lighting of Wellington Hotel, Tunbridge Wells, to which we referred recently, is being carried out by them; and they have also carried out other private installations in that town, including "Firmount." The same company has recently completed the wiring of Collins's Music Hall, having installed the equivalent of 3,000 8-C.P. lamps in a month. Among other contracts now in hand are mentioned installations for the Canterbury Arms, Brixton (including engine and dynamo), various City hotels, the Synagogue, St. John's Wood, the new Synagogue, Great St. Helen's, St. Swithin's Church, Wesleyan Chapel, East Road, &c.

Electrical Engineering in Italy.—A company has just been formed at Florence, with a capital of £80,000, to be known as La Società Toscana per Impresi Elettriche, to establish an electricity generating and distributing station in that city. It is said that Messrs. Schuckert & Co., of Nuremberg, Germany, are interested in the new undertaking.

Electrical Engineering in Germany.—Large new works for the manufacture of electric cables are about to be established at Spandau by Messrs. Siemens & Halske, of Berlin.

Gas.—A gas explosion, which occurred at Leicester on Saturday night last, did a great deal of damage to property. A nurse was thrown violently against the wall and killed on the spot.

Harrison & O'Brien.—This firm, owing to increased business, have removed their offices and testing department from Albany Buildings, 45, Victoria Street, Westminster, to 19 and 21, Queen Victoria Street, E.C. At their new address they are increasing the size of their laboratory and testing department, and will now be able to undertake all classes of work in that line, in addition to out-door testing and inspecting.

New Firm.—We are informed that Mr. J. Foxcroft and Mr. W. J. V. Duncan, late of the firm of Paterson & Cooper, Dalston, have started in business as electrical and mechanical engineers, at 24, Queen's Road, Dalston, where they propose manufacturing arc lamps, switchboards, indicators, &c. We understand that Mr. Foxcroft has had large experience in the manufacture of such goods, having been foreman and manufacturing contractor with the firm mentioned for 20 years.

New Journal.—We have received a copy of No. 1, December, 1897, of a new paper known as the *Journal of Acetylene Gas Lighting*. The journal will be published monthly from 13, Farringdon Avenue, London, E.C. The first number contains, among other items, an introductory article by Prof. Vivian B. Lewes, and "Some Notes on Acetylene" by Hiram S. Maxim.

New Premises.—Mr. Albert C. Hands announces that he has taken showrooms recently occupied by Messrs. Winfield, Limited, at 39, Snow Hill, E.C. Mr. S. Croneen, late of Winfield's, Limited, and Mr. G. Boorman, will represent the firm jointly in London and suburbs, and the country ground will be covered as usual by Messrs. A. C. & G. Hands. Mr. Hands has arranged a partnership with Mr. Harold Davis, of Star Works, Stafford Street, Birmingham.

Refuse Destructors.—Messrs. E. Green & Son, Limited, have received instructions to supply one of their economisers to the Shoreditch Vestry electric light and destructor works. We understand their apparatus is already used with highly satisfactory results at several other destructor plants, including Oldham and Winchester.

Regulating the Height of Incandescent Lamps.—Messrs. Chas. Joyner & Co., Limited, of Icknield Square, Birmingham, are just putting on the market a little contrivance to provide a simple and inexpensive means for altering the height of incandescent lamps without the need of counterweights. The firm is hoping that the device will supersede the unsightly method of looping and knotting flexible cords now used to shorten incandescent leads, which we illustrate herewith. A fluted ball divided into two halves forms the cover to a small reel upon which the flexible cord is wound by turning the fixed nut on the one side. This nut is serrated, so that when the lock-nut on the other side of the ball is screwed up tight the projections on the lock-nut engage in the grooves of the fluted cover and thus prevent the reel turning further. There are two types of this fitting made, one to be fitted up whilst the installation is being erected, and the other a pattern which can be applied to existing lamps by slipping sideways on the flexible cord. The advantages claimed for this device are: it is cheaper and more sightly than counterweights; the best height for the lamps can be found experimentally without knotting cords or breaking connections; the lamps can be wound up to the ceiling if not required in the summer; the fluted ball forms an ornament to plain pendant cords. The device is provisionally protected.

Reported Amalgamation.—It is stated from London, says the *Newcastle Daily Leader*, that the well-known firm of Easton, Anderson & Goolden, Limited, engineers and millwrights, of the Thames Ironworks, Erith, Kent, and Palace Chambers, Westminster, London, S.W., have amalgamated with Sir W. G. Armstrong, Whitworth, & Co. Messrs. Easton, Anderson & Goolden are at present engaged in substituting electric for hydraulic lifts on the Electric Railway, Stockwell and London Bridge, in addition to important contracts for Woolwich Arsenal.

Ryman v. Salmony & Co.—In our recent report of this case heard at the Westminster County Court, we stated that judgment was given for the plaintiffs for the balance of £8 10s. This, we are informed, should be 8s. 10d., which was for postage account. The only business done and paid for was £190 10s. 9d.

The Aston Lamp-Holder.—We illustrate below this new lamp-holder, which is being put before the electrical trade by Messrs. Veritys, Limited. It is claimed that the holder will meet with commendation from the fact that it possesses in a marked manner the two essential features of an ideal lamp-holder—small size and high insulating properties. With respect to the former characteristic, the "ease" is ⅝-inch shorter than that of the ordinary lamp-holder, while a neat and symmetrical outline has been preserved; as to insulation, the holder is provided with a new interior (M. B. Cotterell's Patent), which we illustrate. Fig. 1 shows the "base" end, and Fig. 2, the "lamp" end. Some of the strong points claimed by Messrs. Verity are that (1) Absolutely no metal of either conductor is exposed at the base end of the insulator. The fear of short-circuiting through one conductor being pinched down on to a terminal or plate of opposite polarity is thus altogether avoided. (2) The end of the insulator exposed to the lamp is of solid china, the two plungers alone protruding. Here, again, a short-circuit cannot occur under ordinary circumstances. (3) The chief danger in block terminal insulators is that a strand of flexible or other wire, by protruding too far through

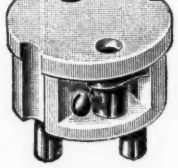


FIG. 1.

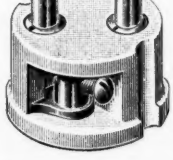


FIG. 2.

the terminal, is liable to short-circuit on to the other pole. In Cotterell's patent interior this is impossible, as the wire can only be passed a slight distance through the terminal. (4) The manner in which the metal parts carrying current of opposite polarity are separated leaves nothing to be desired as to insulating properties. The construction of the interior renders this holder admittedly suitable for use on 220 volt circuits, or even at higher E.M.F. Further, it is extremely easy to wire; its construction is simple; and, although its insulation is so high, the size of the holder is small, being that known as the dwarf type. We have before us a sample of this lamp-holder, and it is excellently made and finished off—in fact, it is one of the best we have seen.

1897.—Messrs. Geipel & Lange, in sending notes of last year's operations, report that the business in Geipel's steam trap or automatic drain cock has increased rapidly during the year, particularly with respect to the electricity supply stations. At present upwards of 40 stations, have adopted these traps, which have already been described in our columns. This trap is also being largely adopted in the States, in Europe, and in the Colonies, for pressures up to 300 lbs. per square inch, while it was awarded the gold medal at the Brussels Exhibition. The manufacture of these traps continues in the hands of the Shillingford Works Company; but on and after January 1st, the sales will be conducted entirely through Messrs. Geipel & Lange, of 68, Victoria Street, Westminster, S.W. During the past year the Westminster business of Messrs. Paterson & Cooper has been sold to Messrs. Geipel and Lange, and notwithstanding the transfer, their staff are stated to have been fully employed. Amongst work which they have carried out during the year, is the complete equipment of the Kennington Road Baths, the new Royal baths at Harrogate, the Church Missionary Society's premises in Salisbury Square, Lambert & Butler's new factory and offices in Drury Lane, Emanuel & Co.'s new premises, Fore Street, Public Market Hall, Harrogate, Dr. Palmer's new house in Queen Anne Street, &c. Messrs. Geipel and Lange have been appointed agents for Messrs. T. Richardson & Sons, of Hartlepool, for the Brown-Boveri power transmission plant, and by Messrs. Ganz and Co. for the Blathy alternate current meters, &c.

ELECTRIC LIGHTING NOTES.

Aberdeen.—Mr. Smith, gas manager, and Mr. Blackman, electrical engineer, have reported to the Gas and Electric Lighting Committee that additional motive power will be required at the electric station in view of the extension of the system. The lighting of the quays from the corporation mains will considerably increase the pressure on the plant, which even now is occasionally very heavy. The engines at present in the station have an aggregate of fully 1,000 H.P., and the committee is to invite tenders for an additional engine of from 600 to 700 H.P.

There is a proposal to light the streets with electricity where electric mains are available, and to light all other streets with incandescent gas lamps.

Belfast.—The Electric Committee report that the new station buildings are now progressing satisfactorily. The contractors expect to have completed the first section of the work by the middle of February, and soon after that the committee hope to be in a position to supply current. The Council has approved of the adoption of Wright's system of charging for electric current from July 1st next. The committee also desire authority to supply and let on hire motors, for which they propose to charge a rental of 15 per cent. on cost to cover interest, sinking fund, and depreciation.

The Council had a brief discussion regarding several increases which it is proposed to make in certain officials' salaries. Mr. V. M'Cowen, the Corporation electrical engineer, was spoken of in very high terms by several members, one speaker saying that he had saved the city at least £3,000 in the drawing up of plans and other matters in connection with the electric light station.

Bexhill.—There will be a Local Government Board inquiry on 12th inst. in reference to the Council's proposed £20,000 loan for electric lighting.

Blockley.—By means of public subscriptions this village is to be lighted with 28 electric lights, and Mr. H. N. Warburton, electrical engineer, has been instructed to proceed with the work.

Chelmsford.—Last week, Mr. A. H. Pott, representing the Chelmsford Electric Lighting Company, attended the district council meeting with reference to the company's application for a provisional order to extend their system to several villages in the neighbourhood of Chelmsford. The Council afterwards almost unanimously expressed the wish that the wires should be laid underground.

Croydon.—The Electric Lighting Committee, after conferring with Prof. Kennedy, recently advised the County Council to authorise the further extension of the plant by the provision of an additional unit consisting of an engine, alternator, and boiler (the same size as that at present on order), at a cost of £5,000. This was proposed in view of the increasing demand for current, and the length of time required to obtain new machinery. The extension was stated to be absolutely necessary, especially in view of the contemplated extensions to Norwood and Thornton Heath.

Darlington.—The Town Council is asking the Board of Trade to amend its 1890 electric lighting provisional order, so as to include the whole borough with the exception of Oxen-le-Fields.

Doncaster.—An application was recently made by Messrs. Fisher & Allison, electrical engineers, asking that the Corporation will give their consent to their supplying electric light to certain persons in the neighbourhood of their shop to the extent of not more than 4 horse-power. A committee recommended that consent be given only until the Corporation are able to supply electricity in the borough and subject to an agreement.

Dublin.—The *Daily Nation* has been endeavouring to interview several members and officials of the Corporation for the purpose of getting to know something regarding the future of the electric lighting undertaking, but none of these gentlemen are to be drawn.

The Dublin and Manchester Steamship Company have asked the Port and Docks Board for permission to erect poles in connection with a proposed installation of electric light at the place on Sir John's Quay where their steamers are to be berthed.

Eccles.—The Electric Lighting Committee have decided, subject to the approval of the Council, to let tenders for the electric lighting of the borough amounting to £9,392. This sum is £2,000 less than the amount sanctioned by the Local Government Board.

Germany.—The Municipal Authorities of Elberfeld have decided on the construction of a second central station in the west end of the town at an estimated cost of £125,000.

Gloucester.—The City Council has resolved to ask Mr. Hammond to meet the Electricity Committee to go into the question of site and give some information *re* the scheme.

Hammersmith.—On Wednesday the Vestry had before it the report of the Electric Lighting Committee with regard to tenders received.

Ipswich.—The Ipswich Board of Guardians have decided by 13 votes to 12 to adopt a system of electric lighting for the Union Workhouse.

The *East Anglian Daily Times*, in a leaderette regarding the matter, concludes as follows:—"Having worked with both gas and electric light we can have no hesitation as to their relative merits, and it would be difficult to find those who have worked by the new light wishing to return to the old."

Kendal.—A sub-committee recommends the appointment of Messrs. Handcock & Dykes, of London, as electrical engineers to report on electric lighting.

Kingston.—In a review of the year the *Surrey Times* says that the electric lighting business of the Corporation has during the year literally progressed by leaps and bounds, no less than 2,375 lamps having been installed, bringing up the total to 9,200, and a substantial profit on the year's working will certainly accrue.

Kintore.—Some days ago the electric light was introduced into the business premises and dwelling house of Mr. W. Hutchson, baker. The dynamo is driven by a powerful oil engine used in his bakehouse.

Lancaster.—Applications have been received for a supply of electricity to several premises in Moor Lane. The engineer is to canvass the neighbourhood in order to ascertain if others are likely to require a supply.

Leeds.—At a special meeting of the City Council, announced for Wednesday (5th inst.), a report was presented by the Parliamentary Committee respecting the proposed purchase of the undertaking of the Yorkshire House-to-House Electric Light Company. If the report was adopted it was proposed to apply forthwith to the Local Government Board for a provisional order to empower the Corporation to issue irredeemable and redeemable stock for the purpose of purchasing the undertaking.

It is stated that a sub-committee is to arrange a friendly conference with the Yorkshire House-to-House Electricity Company, Limited, in the course of the next few days, *re* the proposed purchase.

Lewisham.—The Lewisham District Board of Works have refused to give their consent to the applications of the Great Western Electric Light Company and the County of London and Brush Provincial Electric Light Company for provisional orders to supply electricity in the district.

Liverpool.—A deputation from the Tramways Committee recently waited upon the Lighting Committee with reference to the lighting by electricity of the experimental line of electric tramway. Central poles are to be placed in Prince's Avenue.

London.—At the Commission of Sewers' meeting on Tuesday, the Solicitor (Mr. Baylis) reported the result of the case in which the Commission was sued by the City of London Electric Lighting Company for the non-payment of a sum of £1,442 on an account for lighting the City. It was stated that it was remarked by the Judge that the Corporation should not have stopped the amount, but paid it, and then sued the company for it. Mr. Turner moved that the Solicitor should be instructed to recover the amount. This having been seconded, Mr. C. J. Harris moved, as an amendment, that the question should be referred to the Streets Committee with power to take the necessary steps. Mr. Tranter seconded the amendment, which was carried.

Llanidloes.—The electric light has been installed at the Railway Foundry by the enterprising proprietor, Mr. John Mills.

Manchester.—There is a feeling among some of the members of the Corporation that a grave error was committed when appointing the new Electricity Committee last November in a number of old members of that committee not being re-elected by the Corporation. It is held that the attendance of some or all of these gentlemen on the Electricity Committee is very necessary just now in view of the large extensions of the works and plant which are under consideration. A proposal dealing with the matter was to come before the Corporation on Wednesday, a resolution being placed on the agenda by Councillor Lambert adding the names of the six members who were omitted in November to the Electricity Committee as it now stands.

The Electricity Committee recommends the Council to purchase land in Stuart Street, Bradford, for the establishment of a new generating station. This step is deemed necessary in order to carry out the electrical working of tramways within the city, and to extend the area of electric lighting.

Middlesboro'.—At the last meeting of the Streets Committee, says a local paper, it was decided on the recommendation of the Electric Lighting Committee "that wherever the Streets Committee were laying down new streets they would put a 2-inch pipe, at the cost of the Electric Lighting Committee, through which to thread the electric wires."

Newcastle-on-Tyne.—The plans of Messrs. Lummis-Peterson & Co., for the electric lighting of Heaton Road Wesleyan Church has been accepted. Tenders were sent in by nine firms.

Peterborough.—An important point respecting the electric lighting question came up at the meeting of the Town Council on Tuesday last week. The Electric Extension Company, Limited, having made proposals for the transfer of the provisional order by the Corporation to such company, the Town Clerk was instructed to reply that whilst the reply of the Local Government Board was pending, the Council could not consider such proposal. At a subsequent meeting it was resolved that a letter be sent to the Board of Trade giving notice of opposition to the application for powers by the Peterborough Electric Light Company. The Town Clerk was instructed to again communicate with the Local Government Board urging that an inquiry into the matter of the application of the Council with respect to electric lighting might be held at an early date. With reference to previous correspondence on the subject of the system proposed to be adopted for the supply of energy under the Electric Lighting Order, 1894, the Secretary to the Board of Trade transmitted, for any observations the Corporation might wish to offer, a copy of a memorandum in the matter by Major Cardew, R.E., the electrical adviser to this department. The memorandum stated that with the proposed electrical pressure between the outer conductors it would be necessary that the intermediate conductor be maintained throughout at very nearly the potential of the earth. The simplest means of arranging for this was to connect this conductor with earth at the generating station, but at no other point; and the Board of Trade had in several cases provisionally approved of such connection under certain conditions. As the negative conductor of the proposed bare copper mains would necessarily be maintained at a potential of 220 volts negative to earth, there would be a strong tendency to the occurrence of leakage at the insulators, involving possible dangers from electrolytic action, and should this system of mains be used, it would be necessary to provide for rigid inspection of all the insulators. The engineer, having had a consultation with Dr. Fleming, recommended that the following observations be forwarded: (1) If the electrical pressure of 440 volts between the outer conductors is adopted, the middle wire will be connected to earth at the generating station, but at no other point, and the undertakers will comply with any provisions or conditions the Board of Trade may desire. But in making application for permission to use 440 volts between the outer conductors, the undertakers wish to retain the power to use the lower pressure of 220 volts if it should be thought desirable; (2) the system of distribution proposed to be used is continuously-insulated mains, and the bare copper was only mentioned in case it might be considered desirable to use it at any special point. If any bare copper is used, such insulators and means of inspection will be provided as meet with the approval of the Board of Trade. The Town Clerk was instructed to forward these

observations to the Board of Trade.—The Town Clerk read the following letter: "Local Government Board, Whitehall, S.W., December 23rd. Sir,—I am directed by the Local Government Board to advert to your letter of the 11th inst. relating to the application by the Town Council of Peterborough for sanction to borrow £15,000 for works of electric lighting, and I am to state that according to the latest information in the possession of the Board the Council's margin of borrowing powers is not sufficient to enable them to borrow the sum of £15,000 in addition to the sum of £4,500 for which they desire sanction to borrow for hospital purposes—I am, yours faithfully, A. D. Adbian, Assistant Secretary."—The matter came before a special Council meeting on Wednesday.

Power Distribution Scheme.—The Bill promoted by the General Power Distributing Company, for providing electric power in a 26 miles area was considered by the Council the other day, and it was resolved that the Bill be opposed, in conjunction with the other local authorities. The Nottingham City Council has appointed a strong committee to oppose the scheme.

Shoreditch.—The Lighting Committee has advised that the application of the County of London and Brush Electric Light Company for a way leave for cables in a direct line through, without supplying current in, the district of the Vestry, at a rent of £50 per annum, be not granted.

Swinton.—A Committee of the District Council is considering the question of electric lighting by a private company.

Torquay.—Under the direction of Mr. Storey, engineer-in-charge, the electric lighting works are being pushed forward. Two sets of machinery have been received, and all three boilers have been submitted to full steam pressure, the trials having proved in every way satisfactory. There are now 44 consumers on the mains, and 3,000 8-C.P. lamps have been placed in the residences and shops of the town. The streets will be lit by 57 arc lamps.

Tunbridge Wells.—It is proposed to accept the lowest tender sent in for building extensions to the electricity works, *i.e.*, that of Mr. W. J. Logan at £1,059.

Ventnor.—Mr. Pressland recently wrote on behalf of the Ventnor Electric Light and Power Company asking for the approval of the Council to the site for the station. The application was granted.

Walsall.—The Grand Theatre, Walsall, was lighted electrically on 22nd ult. for the first time. The stage is now illuminated by 170 electric lamps of various colours, which can be manipulated from a switchboard so arranged that the illumination can be red, green, or white at a moment's notice. The theatre itself is also now completely lighted with electricity.

Wednesbury.—The Council will oppose the application of the Midland Electric Corporation for a provisional order, it being considered that the work ought to be in its own hands.

West Hartlepool.—A Local Government Board inquiry was held last Tuesday *re* the Corporation's proposed £30,000 loan for electric lighting.

West Derby.—The Board of Guardians of the West Derby Union have instructed Mr. Thos. L. Miller, M.Inst.E.E., of Liverpool, to prepare full plans and specifications, and to invite tenders, for the lighting of their Mill Road Infirmary by electricity. The installation, we understand, is estimated to cost upwards of £5,000.

Westminster.—The Board of the Westminster Electric Supply Corporation, Limited, has decided to reduce the rate of charge for electric energy as follows:—From January 1st, 1898, the price charged for current used for lighting purposes will be at the standard rate of 6d. per Board of Trade unit for the first 4,000 units used in each year. All units used in each year in excess of 4,000 will be charged at the net rate of 4d. per unit. The price charged for current used solely for purposes other than lighting, and supplied through a separate meter, will be at the rate of 3d. per Board of Trade unit.

Wormit.—Inquiries are being made among the residents as to whether they are in favour of electricity, gas, or oil as an illuminant for the village. If two-thirds are in favour of electric lighting a detailed scheme will then be submitted to a public meeting.

ELECTRIC TRACTION AND MOTIVE POWER NOTES.

Blackpool.—The Tramway Committee, a short time ago, applied to the Local Government Board for permission to substitute the overhead trolley system for the conduit system of electric traction on the promenade. Not only has the board refused this permission, but it has condemned the existing conduit system as well. This has come as a surprise upon the committee, who are going to interview the officials in London on the matter. Meanwhile they have decided to lay a tramline through Claremont Park, instead of along the low promenade.

Bristol.—Last Saturday the Tramway Committee appointed to negotiate with the Bristol Tramways and Carriage Company for the purchase of the system, reported to the City Council that the company absolutely refused to negotiate, and were now promoting two Bills for extending the system.

Collision.—On 26th ult. an electric tram collided violently with a motor car at Haddington Road, Dublin. The ends of both cars were considerably damaged. The cause of the accident is believed to be the failure of the motor brake to act.

Croydon.—A correspondent of the *Bullionist*, referring to the proposed purchase of the Croydon Tramways Company's undertaking by the British Electric Traction Company, says that the terms of the sale are "manifestly unfair to the ordinary shareholders." The meeting, he says, was held with doors closed to the press, and he is taking steps to see whether it is too late to prevent the sale on the terms proposed.

A Norwood paper says that the tramways system has been taken over by the British Electric Traction Company, who will introduce electrically-driven cars, and Mr. H. A. Durke's services are retained for the management of the new company.

Derby.—The proposed purchase of the tramways by the Council has been making progress in the hands of a committee, and the company has intimated that it is prepared to negotiate for the sale of the undertaking. With a view to making an offer to the company, the committee propose that an engineer be employed to advise them on the matter. The question of electricity is being taken into account.

Dublin.—The extension of the United Tramway system which will connect Rathmines by direct route with the electric tram near Ballsbridge is being pushed forward energetically. Already a large portion of the line is laid down. The length of the new tram line will be close on 2½ miles. The effect of the new line will be to connect the extremities of the southern townships from the eastern side of Rathmines Township at Haroldscross to the Pembroke Township at Ballsbridge, and thence near Haddington Road with Sandymount. The entire work is being carried out by the United Tramway Company's own men, who have laid the rails.

Light Railways.—The proposal of the British Electric Traction Company to construct light railways in the Fenton District is not to be opposed by the Fenton Council.

The proposals to construct light railways between Highgate and Finchley, and Finchley and Hendon, were before the Finchley District Council last week. Mr. Vesey Knox, M.P., barrister, appeared on behalf of the electric scheme, and submitted that the system proposed—overhead electric trolley—was the only one possible for such a rural district, and if there was a fatal objection to the system, that would be fatal to the scheme. They proposed to light the road along the line of route at a price to be agreed upon with the Council; a quick service to Hampstead, and, consequently, a service to the West-end of London and an additional local service to the Great Northern Railway. Owing to the provisions of the Tramways Acts, they proposed a street traction far superior to any existing in this country at present; fares of 1d. per mile (but anticipated four miles for 3d.); the average speed (time table), eight miles throughout, was proposed; repair of 18 inches on each side of the lines, which meant where double lines existed 16 feet; the posts would be of an ornamental character, on one side of the road only; purchase by the local authority at the end of 35 years. The only object they had in going under the Light Railways Act was to save the expense of a Parliamentary Bill. They intended putting on a special service for the working classes. They had power to carry goods, but the passenger traffic was locked to; they did not intend to combine goods and passenger cars.

Lucan Tramways.—The Lucan Steam Tram Company are, says *Freeman's Journal*, at present in communication with the Board of Trade with reference to the inspection of the line from the Conyngham Road to Leixlip. It is expected that the inspection will shortly be made, and that the line will soon afterwards be open for traffic. The line has been completely relaid, new rails put down, and the gauge has been widened from the former one of 3 feet to 3 feet 6 inches. The cost of re-sinking the line is nearly £16,000. The remaking was undertaken with a special view to the line being worked by electricity, and provision has been made for the ultimate carrying out of that intention. The introduction of electricity for traction purposes will involve an additional outlay of about £15,000. Until that work may be undertaken, the line will be worked by steam. It is estimated that the conversion of the line, as it is now constructed, into an electrically equipped line, will be carried out in four months, and that change will involve a stoppage of the traffic for that length of time. The board of directors are in negotiation with a London firm of contractors for this work, and if there is a prospect of the work being completed by the summer, it will be commenced as soon as the contract is signed. Otherwise the summer traffic will be carried on by the steam haulage, and the electrical equipment will be postponed until the close of the summer season. The trams with the steam haulage will run every hour, and with electric traction they will be run every half hour. The system of electric traction to be adopted is the trolley overhead wire. The power house will be erected about midway on the line, near St. Lawrence's Road. The dynamos will be driven entirely by steam, as the board has been advised that the water power would not be sufficient. When the contract is completed, the building of the power house will be first commenced.

Manchester.—The Special Committee of Tramways appointed by the Corporation recently resolved: "That the electrical equipment and the supply of the electric current necessary for the working of the tramways of the Corporation within the city be placed in the hands of the Electricity Committee, and that they be requested to take the necessary steps for the carrying out of the work; the terms of payment for the current to be supplied to be hereafter arranged." The Electricity Committee, with a view to carrying out this resolution,

and also for the purpose of extending the area within which the current can be supplied, have resolved upon the Stuart Street site. It is intended to convey the current from this generating station to convenient sub-stations situated in various parts of the city. A deputation will interview the several local authorities through which the existing tramcar service runs in reference to the Manchester Corporation supplying electric traction beyond the limits of the city. The Town Clerk is to report as to the steps to be taken for acquiring the lines belonging to the Manchester Carriage and Tramways Company within the city.

Motor Vans.—The borough engineer of Wolverhampton, Mr. Bradley, has issued the particulars of the motor vans required by the Wolverhampton Corporation.

Nottingham.—It is understood that a sub-committee of the Tramway Committee is considering what is the best system of traction to be adopted for the tramways instead of horses.

Proposed Electric Railway.—A Bill "for incorporating the City and Brixton Railway Company, and for empowering them to construct an underground railway from the City and South London Railway to Brixton Hill," has been deposited for next Session. The proposed railway, which will be nearly $3\frac{3}{4}$ miles in length, will commence by a junction with the City and South London line under the High Street, Borough, and will terminate under Brixton Hill. In connection with the railway it is proposed to widen the City and South London line near London Bridge Railway Station, and also to construct a railway connecting with the Kennington Oval Station of that line. The capital required by the proposed company is £1,200,000, with power to raise a further sum of £400,000 by the creation of debenture stock. The Bill also seeks power to enable the company to acquire by purchase or lease so much of the existing City and South London Railway as lies between their proposed point of junction in the Borough and King William Street in the City.

Proposed Electric Railway from Charing Cross to Paddington.—A Bill to incorporate a company for the purpose of constructing an underground electric railway from Charing Cross to Paddington has been deposited at the Private Bill Office. The proposed railway will commence, says the *Times*, to the north of the Avenue Theatre, at the southern end of Northumberland Avenue, and will terminate on the south side of James Street, near Paddington Station. In connection with this railway it is proposed to construct a subway to the Great Western Railway Company's Paddington Station and another subway to Albert Terrace, Knightsbridge. The capital required for this scheme is £1,500,000, which is to be divided into 150,000 shares of £10 each, with the power to divide them subsequently into "preferred half-shares" and "deferred half-shares." Upon this capital it is proposed to raise a further sum of £500,000 by the creation of debenture stock. The time stated for the completion of the line is five years, during which period it is proposed to pay interest out of capital to an amount not exceeding £70,000. The Bill proposes to authorise the company to enter into agreements with the Great Western and South Eastern Railways. The promoters of the scheme are Sir George Russell, Mr. Henry Cosmo Orme Bonsor, and the Hon. Alfred E. Gathorne-Hardy, who, with "four other duly qualified persons to be nominated by them," are to be the first directors of the company.

St. Helens.—Dr. Hopkinson has submitted his report to the Gas and Lighting Committee with respect to the introduction of electrical traction upon the tramways. He advises that no further extension of the electricity works be made pending the completion of the works for supplying the energy for traction, the committee in the meantime putting up with the risks of any inconvenience that might arise. The committee has resolved that the question of the extension of the present plant be postponed, and that only such additions to the undertaking as may be absolutely necessary be made for the present. It was further resolved that the present machinery for the electric supply of the Town Hall be left in such a condition, that if the necessity should arise, the Town Hall and the Gamble Institute may be connected therewith.

TELEGRAPH AND TELEPHONE NOTES.

Delays in Australian Telegrams.—During the progress of the cricket match played at Melbourne this week, we find among the items of cricket news in the evening papers the following paragraph:—"There has been considerable delay in the transmission of our special cables to-day, and Dalziel's agency is informed by the Eastern Telegraph Company that this is due to irregularity in the working of the land-lines in Australia." As we have previously pointed out, the relation between cricket and telegraphy is not at once apparent; but thanks to the keen general interest felt in the former, the public is enabled to get some insight into the deficiencies of the latter. A business man must needs tolerate in disgust and silence, an inconvenience which those interested in sport would not think of suffering for a moment. In spite of the airy protestations of the Postmaster-General of South Australia, who assures the London Chamber of Commerce in reply to a protest made by them—that the Australian land-lines are rarely interrupted—we find on looking into the matter that during the past year, at the very lowest computation, there have been seven occasions on which the failure of these lines have been sufficiently marked to call for notice in the Australian press. Although in January last the interruption on the South Australian land-line lasted about four days; and although the interruption to the same line last month continued for about four or five days, still we are supposed to derive complete consolation and conviction from an official assurance that such things rarely or never occur, and are not to be anticipated in the future; so thus in dealing with any proposal to furnish a trustworthy means of telegraphic communication with Australia, we are to consider that cause of complaint as regards the existing lines is, officially, a myth! We use the word officially, of set purpose, as in spite of the fact that the various Australian provinces have, officially, bound themselves (with, perhaps, the exception of Queensland), to report any such interruptions to the International Telegraph Bureau at Berne, yet they fail to keep their bargain; and even when specifically challenged by the London Chamber of Commerce, one of the more prominent of these Postmasters satisfies himself by writing an explanation, which cannot possibly satisfy anybody else who knows the truth of the case.

Huddersfield Telephones.—The Huddersfield Chamber of Commerce had a discussion on 31st ult. *re* municipalisation of telephones.

Middlesbrough Telephones.—The Streets Committee has considered the unsatisfactory state of the telephone service in the town, and has resolved to ask the Mutual Telephone Company, of Manchester, who are desirous of extending their services to Middlesbrough, their terms for connecting all the municipal offices in the town.

Pacific Cable.—Sir Sandford Fleming, in a communication made to the Press, urges the Government of Canada once more to take up the project for a Pacific cable. He argues that the proposal of the Eastern Extension Company, which resulted in the suspension of the Pacific cable project at the last conference, would not adequately fulfil the purpose, what is required being an auxiliary system free from liability to interruption. He declares that the Pacific cable scheme was pronounced impracticable, expensive, and in the interests of the Eastern Extension Company only. The Australasian Colonies being politically disunited, Sir Sandford Fleming holds that it behoves Canada to make definite proposals, for which the mother country is waiting: "If we are to be brought within speaking distance of kindred communities in the Southern Seas," he concludes, "the first impulse must come from ourselves."

Telegraph Delays.—A deputation from the Liverpool Chamber of Commerce waited upon the Postmaster-General on 29th ult. for the purpose of complaining of the delays in the transmission of telegrams between Liverpool and the Continent. Mr. P. E. Hemelryk asked the Postmaster-General to urge the French and German Governments to expedite matters on their side. The Duke of Norfolk promised to give the various points raised his most careful consideration, and undertook that a new duplex wire should be made available between Liverpool and Hamburg. He also held out a hope that telephonic communication would, if it were found practicable, be established between Liverpool and Havre.

Telegraph Rates for the West Indies.—The West India and Panama Telegraph Company and associated companies have determined to apply from 1st inst. a large reduction in rates between Europe and Jamaica. The reduction amounts to 2s. 10d. per word between Europe and Jamaica, or from 5s. 10d. to 3s. per word. The same reduction will be extended to the West India and Panama Company's stations east of Jamaica, and will also include Demerara. The tariff with the French Islands of Guadeloupe and Martinique will, however, it is understood, for the present remain without alteration.

Telegraphic Interruptions and Repairs:—

CABLES.	Down.	Repaired.
Brest-St. Pierre (Anglo, 1869)	April 6th, 1893 ...	...
West Indies—		
St. Croix-Trinidad ...	Nov. 30th, 1896 ...	...
Grenada-Trinidad ...	Dec. 29th, 1897 ...	Jan. 4th, 1898
Cape Haytien-Puerto Plata	Dec. 31st, 1897 ...	...
Puerto-Plato Martinique	Dec. 31st, 1897 ...	...
Amazon Company's cable—		
Parintins-Itacatiara ...	May 5th, 1896 ...	...
Obidos-Parintins ...	Dec. 7th, 1896 ...	...
Otranto-Vallona	Oct. 11th, 1897 ...	Dec. 31st, 1897
San-Thomé-Loanda	Dec. 13th, 1897 ...	...
Saigon-Thuanan	Dec. 20th, 1897 ...	Dec. 31st, 1897
Ceara Maranham	Dec. 23rd, 1897 ...	...
Teneriffe-St. Louis (Senegal)	Dec. 24th, 1897 ...	...
Para-Maranham	Jan. 3rd, 1898 ...	...
LANDLINES.		
Trans-Continental line beyond Masol	March 14th, 1896 ...	...
Carthagena - Barranquilla (Columbia)	July 4th, 1896 ...	...
Communication with Yucatan	Dec. 25th, 1897 ...	Dec. 30th, 1897
Dominica landlines	Dec. 31st, 1897 ...	Jan. 3rd, 1898
Fao landlines...	Jan. 3rd, 1898 ...	...

Telegraphists' Grievances.—The executive committee of the London branch of the Postal Telegraph Clerks' Association have prepared a list of the grievances of which they complain, and will publish them in the form of a manifesto.

The American Pacific Cable Company.—The Pacific Cable Company, of New York, met some weeks ago and elected the following directorate:—J. Pierpont Morgan, Edmund L. Bayliss, J. Kennedy Tod, Rear Admiral John Irwin, U.S. Navy, and James A.

Scrymser. Mr. Scrymser was elected president, and Mr. Edmund L. Bayliss vice-president and acting treasurer. The company announces that the surveys for the cable between the coast of California and the Hawaiian Islands are highly satisfactory, and that arrangements are being made for the establishment of that section within 18 months. It will require over 9,000 miles of cable to connect the United States with the Hawiian Islands, Japan, China, and Australasia. The proposed Pacific cable between America and Hawaii will be up before Congress this session. A Bill was introduced in the 54th Congress authorising the Pacific Cable Company, of New York, to lay this cable. After being reported favourably by the Committee on Commerce in the House, it was sent to the Postmaster-General for a report. This report has not as yet been given out, but, according to the New York *Electrical Engineer*, it is said will be presented to Congress soon after it assembles. Mr. Edmund L. Bayliss, vice-president of the company, states that the Government had completed a survey of the route as far as the Hawaiian Islands, and if the Bill passed at the coming session the cable would be in running order in 1898.

CONTRACTS OPEN AND CLOSED.

OPEN.

Bilbao.—February 28th. The Secretary of State for Foreign Affairs has received a despatch from Her Majesty's Consul at Bilbao, reporting that the provisional board appointed in connection with the electric tramway which it is proposed to lay from Zumarraga to Zumaya, in the province of Guipuzcoa, invite plans and tenders, to be received by February 28th, for the construction and equipment of the line. Further particulars of the conditions of the tenders for the above-named tram line and branch, which together measure 30 miles, may be inspected at the Commercial Department of the Foreign Office any day between the hours of 11 and 6.

Bedford.—January 10th, 1898. The Electric Light Committee want tenders for the supply and erection of a 420 B.H.P. double-acting compound enclosed engine, and a 250-unit alternator with stationary armature. See our "Official Notices" December 10th for particulars.

Bootle.—January 10th, 1898. The Corporation wants tenders for the supply and erection of boilers, engines, dynamos, switchboard, pumps, transformers, wiring, alteration of Town Hall wiring, batteries, mains, street boxes, and the running of the electricity works for three years. Consulting engineer, Mr. T. L. Miller, 7, Tower Buildings, Water Street, Liverpool. See our "Official Notices" December 10th for further particulars.

Bradford.—January 13th. The Corporation are asking for tenders for two steam engines for their electricity works at Valley Road. Further details will be obtained from our "Official Notices."

Bedford.—January 24th. The Corporation want tenders for the supply and delivery of vulcanised rubber cables. See our "Official Notices" this week.

Blackburn.—January 22nd. The Corporation want tenders for a 500-kw. continuous current steam dynamo, and a 120-kw. steam alternator. Consulting engineer, Mr. E. M. Lacey. See our "Official Notices" this week.

France.—January 22nd. The Municipal Authorities of Neuilly-sur-Seine are inviting tenders for the concession for the establishment and working of a central electric station in the town. Particulars from, and tenders to, La Mairie de Neuilly-sur Seine.

Gloucester.—January 18th. The Electricity Committee want tenders for boilers, dynamos, overhead crane, switchboard, accumulators, mains, arc lamps, meters, &c., for electric lighting. Consulting engineer, Mr. Robert Hammond. See our "Official Notices" December 10th.

Guernsey.—Tenders are wanted for the States of Guernsey for the supply of several hundred creosoted telegraph poles, ranging from 22 to 60 feet. Particulars from Mr. A. R. Bennett, 44, Manor Park Road, Harlesden, London.

Guipuzcoa.—February 28th. The Secretary of State for Foreign Affairs has received a despatch from Her Majesty's Consul at Bilbao, reporting that the provisional board appointed in connection with the electric tramway, which it is proposed to lay from Zumarraga to Zumaya, in the province of Guipuzcoa, invite plans and tender, to be received by February 28th, for the construction and equipment of the line. Further particulars of the conditions of the tenders for the above-named tramline and branch, which together measure 30 miles, may be inspected at the Commercial Department of the Foreign Office between 11 and 6.

Leicester.—January 31st. The Leicester Corporation invites designs and tender for motor vehicles for the collection of house refuse. Specifications and particulars, with drawings, to be sent to the Chairman of the Sanitary Committee, to the office of Mr. E. Geo. Mawbey, C.E., borough engineer, Town Hall, Leicester.

Newport.—January 24th. The Electricity Committee want tenders for the supply and erection of mains, transformers, switch gear, cast-iron posts and for arc lamps. Consulting engineer, Mr. Robert Hammond. See our "Official Notices."

Roumania.—March 15th. Tenders are being invited by the General Direction of the Roumanian Post and Telegraphs in Bucharest for the supply of 56,000 metres of galvanised iron and steel wire.

Shoreditch.—January 11th. The Vestry want tenders for wiring materials for one year. Particulars can be seen at the Lighting Engineer's Office, Town Hall.

Spain.—January 9th. The municipal authorities of Torrente (Valencia province) are inviting tenders for the concession for the electric lighting of the town during a period of 17 years. Tenders to be sent to El Secretario del Ayuntamiento de Torrente (Valencia).

Tunis.—Tenders are at present being invited (no date being mentioned) by the Société Immobilière d'Hamman-lif, near Tunis, for the construction of an electric tramway, about 10 miles long, between Tunis, Maxula-Rades and Hamman-lif.

CLOSED.

Bo'ness.—The contract for the whole of the electrical equipment of the Bo'ness Docks has been given to the Brush Electrical Engineering Company.

FORTHCOMING EVENTS.

1898.

Saturday, January 8th, at 3 o'clock.—Royal Institution of Great Britain. Sixth (concluding) juvenile lecture on "The Principles of the Electric Telegraph," by Prof. Oliver Lodge. Subject:—"Space Telegraphy."

Monday, January 10th.—Northern Society of Electrical Engineers, Palatine Hotel, Manchester, at 8 o'clock. Presidential Address by Mr. Raworth.

Tuesday, January 11th, at 8 p.m.—The Institution of Civil Engineers. Paper to be read with a view to discussion:—"The Machinery used in the Manufacture of Cordite." By E. W. Anderson, Assoc.M.Inst.C.E. Monthly ballot.

Röntgen Society. General meeting at 11, Chandos Street, Cavendish Square, W. Paper at 8.30 p.m. by W. Webster, F.C.S., "Practical Work with the X-rays."

Wednesday, January 12th, at 7 p.m.—Society of Arts. Second juvenile lecture, by W. Ramsay, Ph.D., F.R.S., on "Fire."

Thursday, January 13th, at 8 p.m.—The Institution of Electrical Engineers. Presentation of premiums. Inaugural address of the President, Joseph W. Swan, Esq., F.R.S.

Friday, January 14th, at 8 p.m.—Institution of Civil Engineers. Students' meeting. Paper to be read:—"Mechanical Draught." By R. Gordon Mackay, Stud.Inst.C.E. Sir Albert J. Durston, K.C.B., M.Inst.C.E., will preside.

NOTES.

Cable Factory Changes Hands.—We learn that the well-known cable factory of the Fowler-Waring Cables Company at North Woolwich has been acquired by the Western Electric Company, of 79, Coleman Street, London, E.C., Chicago, and Antwerp.

Personal.—On the recommendation of the Minister of Trade and of Posts and Telegraphs of France, the President of the Republic has promoted M. Léonard Raymond to the grade of Commander of the Légion d'Honneur. The Presidential decree describes M. Raymond as Administrator of Postes and Telegraphs, with 44 years of administrative service, and as Officer of the Légion d'Honneur since April 14th, 1876. M. Raymond represented the French Government at the International Telegraph Conference of Buda-Pesth in 1896, as chief of the delegation of that country, and won the sympathies of those who had not enjoyed the pleasure of his acquaintance previous to that meeting, and we are sure his numerous friends will rejoice at the distinction conferred on him by his country's Chief of the State.

Electrical Illuminations.—On New Year's Eve many public and private buildings in New York were decorated with strings of electric lights in honour of the extension of the City boundaries. At the stroke of midnight search lights were turned on the flagstaff at the City Hall. An electric current sent a furled flag to the top of the mast and unfurled it.

The Northern Society of Electrical Engineers.—Notice is given that a special general meeting of the members of this society will be held at the Palatine Hotel, Manchester, on Monday, January 10th, 1898, at 7.30 p.m., when the following Amendments to Rules XXII. and XXXVI., agreed to at the special general meeting of the members held on the 22nd inst., will be submitted for adoption on the proposal of the Council:—

That Rule XXII. be altered to read as follows:—

The Council shall, previous to the annual general meeting in each year, prepare a list of members whom they propose as suitable for the offices of President, Hon. Treasurer, and Hon. Secretary for the ensuing year, and also a list of members who shall have been nominated for the four vacancies on the Council. Such nominations shall be effected by any retiring member of Council, or other qualified person, being proposed and seconded in writing by two members and supported by four other members. These nominations, together with the written consent of such nominees to accept office if elected, shall be forwarded to the secretary 21 days previous to the annual general meeting. If, after this date, there shall be no more nominations than vacancies the person so nominated become elected, but if there shall be more nominations than vacancies each member shall be at liberty to make a selection from such list, provided the number of names so selected shall not exceed in any case the number requisite to fill the vacancies. Ballot papers shall be so marked and recorded as may be from time to time determined by the Council.

That Rule XXXVI. be altered by the inclusion of the words shown in italics:—

Every Member or Associate shall have the privilege of introducing two visitors to the ordinary general meetings of the society, but no visitor *who is eligible as a Member or Associate* shall be permitted to attend more than twice in any one session except by permission of the Council.

Obituary.—We regret to announce the death, at Cadiz, on the morning of January 4th, of Mr. W. F. O'Brien. For some years past Mr. O'Brien had not enjoyed the best of health, but he had made, during his short stay at Cadiz, such marked improvement, that the news of the relapse which proved fatal, was received in London as an unexpected shock. A large number of our readers have met Mr. O'Brien either in business connected with telegraphic matters, or socially, and in his capacities, both as a telegraph man and as a friend, his loss will be deeply deplored by the large circle which appreciated his many sterling qualities. His knowledge of telegraph affairs, his grasp of every detail connected with his business, and his devotedness to the work, rendered him invaluable in the position he occupied; while his straightforward character and his constant readiness to attend to the interests of others secured for him many and sincere friendships. Mr. O'Brien, after serving in the Postal Telegraphs for some years, entered the employment of the Japanese Government at the moment when the development of the telegraph was first seriously commenced in Japan. On the termination of his agreement with the Japanese Government he joined, in 1875, the West Coast of America Telegraph Company. On the expiration of his term of service he returned to England, and was attached to the staff of the Silvertown Company, and lent valuable services on many cable expeditions. In 1884 he was appointed traffic accountant to the West African Telegraph Company, and at the time of his death held that position in the South American Cable Company and the Spanish National Submarine Telegraph Company. He served the latter company for fourteen years, and during the last year also acted as secretary. Mr. O'Brien attended, on behalf of the companies he served, the International Telegraph Conventions of Paris and Buda-Pesth. We beg to be permitted to offer his family our most sincere sympathies for the great loss they have sustained.

The Chatsworth Festivities.—Messrs. Drake & Gorham received instructions to carry out a number of illuminations in connection with the visit this week of the Prince and Princess of Wales to Chatsworth. The whole of the building was lit up by a special system of reflected light that was much admired. Jandus arc lamps were employed. A search light was fixed on a platform above the roof, and threw a beam on to each of two fountains. These fountains were each illuminated by means of four projectors worked from water-tight boxes placed in the centre of the fountain itself. An illuminating device, known as the electroflame, patented by the firm in connection with the Jubilee illuminations, was shown to great advantage in the centre of the building.

The Engineers' Strike.—Mr. Alexander Siemens, speaking at the dinner of the Article Club on Wednesday night, said the most important question for the commerce of England was at present the great struggle in the engineering trade. The struggle had been going on for six months, but the masters, whose interests were not much in common, had held together, and he could assure them that they would hold together still. There was not the slightest intention whatever on the part of the masters of going back from the terms they agreed upon at Westminster with regard to the management of works in the future, and they would not yield to the demand for diminished working hours. The masters had been defending the right of liberty. The trades unions would not allow their men to work as they could, and if any man was working particularly well, earning extra wages, and doing more than other men, he was hauled before the District Committee, and told he must restrict his production, or he would be fined, or expelled from the union. The masters wanted to do away with that kind of thing. At the same time they had made it compulsory that collective bargaining should be resorted to. With regard to these rules of management, he would call their attention to a very curious point. At the last sitting of the Conference the delegates of the men agreed to these rules, and said if they were given 54 hours' pay for 51 hours' work, they would accept the rules of management, and tell their men to go back to work on the following Monday. When, however, they found the masters would not give in on the question of hours, the delegates turned round and said the rules of management struck at the root of trades unionism, and they must refer the matter to the vote of the men. If the rules of management were right one moment, why were they wrong simply because the employers would not give way on the question of hours? Mr. Knight, the Secretary of the Boilermakers' Society, had also pointed out that his society had been working under these rules for years, and was flourishing under them, and they did not find them hostile to trades unionism. These rules, too, were not a new invention. They were only such as had been in use at some of the works of the Federated Employers where trade unionists were employed before the commencement of the dispute. Why, therefore, did the delegates say all of a sudden that they struck at the root of trades unionism? He would take that opportunity of saying that the Federated Employers had been resisting the demands of the trades unions quite as much in the interest of the individual workmen as in their own interest. The masters were absolutely united, as much now as they were on the first day during these six months, and, far from anybody having broken away from the Federation, other firms had joined and posted notices. That showed that they had a good cause, and they meant to fight for it to the end.

Congratulations.—In the list of New Year honours appears the name of Mr. Spencer Walpole, the secretary to the Post Office, who is made a K.C.B., also of Mr. James Dredge, whom the Queen, on the recommendation of the Secretary of State for Foreign Affairs, has appointed a C.M.G. in the Order of St. Michael and St. George. This honour is bestowed in recognition of services rendered in connection with the Brussels Exhibition. We have pleasure in congratulating Mr. Dredge.

Erratum.—In the article in last week's issue on "Localisation of Breaks and Partial Earth Faults in Submarine Cables," on p. 919 (December 31st, 1897) Formula B should read as follows:—$x = R_1 - (R_2 - R_1)$ ohms, *instead* of $R_1 (R_2 - R_1)$ ohms.

Fire.—During a cinematograph exhibition at Bolton last Saturday, a fire occurred in connection with the electrical apparatus. There was a panic among the audience, and the operator and others were slightly burned.

London Fogs and Artificial Light.—London fog absorbs 11·1 per cent. of the luminous rays from an ordinary gas flame, while 20·8 per cent. of the light from an incandescent mantle are lost in it. This is of course due to the fact that the first-mentioned light contains far more red rays than the other, and that fog permits the passage of red rays to the exclusion of the blue is evident from the deep red colour which the sun assumes when seen through mist.—Cosmos.

Electric Launch for the Czar of Russia.—At the time of the great Naval Parade in New York Harbour, in 1892, the Grand Duke Alexander, in command of the Russian warships, was so pleased with the electric launch of the U.S. cruiser *New York*, that he purchased it from the Navy Department for his own use. The performance of this boat, built by the Electric Launch Company, of New York, came under the notice of the Czar of Russia, and the result has been, says the New York *Electrical Engineer*, that the latter, a short time ago, ordered one for his own use, which is now under construction at the works of the Electric Launch Company, at Morris Dock, N.Y., under the personal supervision of Mr. J. C. Chamberlain, president of the company, in connection with Capt. D. T. Mertvago, naval attaché of the Russian Legation at Washington. The dimensions of the gig will be as follows:—Length over all, 37 feet; length on load water line, 35 feet; beam, extreme outside of planking, 7 feet $3\frac{3}{4}$ inches; draught of hull, 2 feet 3 inches; length of cockpit, or seating space, 14 feet 9 inches; greatest width of same, 6 feet 5 inches; displacement, without passengers, not to exceed 5·2 tons. The storage batteries, furnished by the Electric Storage Battery Company, will be of the most improved and modern type, all contained in hard rubber cells, with tight-fitting covers, and placed under the flooring and seats. The number and grouping will be such as to adapt them to be charged from a 110-volt circuit. The motor built to conform to the hull will be of special marine type with self-contained ball-bearing thrust fitted under the floor in its compartment, and directly connected with the propeller shaft. The controller for regulating the speed of the motor will be placed under the forward deck, and operated by a shaft extending through the steering wheel bearing. This controller will be capable of effecting five variable speed rates, from slow starting to spurting speed, and also adapted for reversing the motor with three variable speeds. The gig is to have a speed of eight miles an hour for three hours, or seven miles an hour for six hours, but the controller is arranged to admit of a spurting speed up to 11 miles per hour if desired. The gig is to be delivered and placed in commission by the builders' representative, who is also to instruct the crew in its care and operation.

Motor Cars.—A letter, evidently "writ sarcastic," appears in the *Engineer* from one "J. G. S.," who wants a motor carriage of some kind. He can find no advertisers of these vehicles, and asks are makers full of orders, and overflowing? We think not. There are, we believe, some genuine makers of motor carriages, but we fancy that many of the much-puffed companies which were started to make motor cars were left by their philanthropic promoters with insufficient capital to properly carry on the manufacture and the exploitation of the new industry. But all were not imaginary, and from time to time vehicles appear in the streets of London which seem to evidence the fact that there is a motor car industry.

NEW COMPANIES REGISTERED.

Wm. Coates & Son, Limited (2,172).—Registered in Dublin December 22nd, with capital £25,000 in £10 shares, to carry on a or any of the following businesses, either wholesale or retail, and either jointly or solely with others, electrical engineering in all its branches, plumbers, gas or steam fitters, &c. The subscribers (with one share each) are:—W. T. Coates, 1—11, Fountain Street, Belfast, merchant; W. C. Macann, 1—11, Fountain Street, Belfast, merchant; E. S. Dashwood, 1—11, Fountain Street, Belfast, electrical engineer; G. D. Coates, 5, Chilworth, Belfast, bank manager; R. Hamilton, 37, University Road, Belfast, secretary; T. G. Megaw, 1—11, Fountain Street, Belfast, cashier; T. J. Moore, 1—11, Fountain Street, Belfast, salesman. The number of directors is not to be less than three nor more than five. The first are W. T. Coates, W. C. Macann, and E. S. Dashwood; qualification, 200 shares; remuneration as fixed by the company. Registered by Crawford & Lockha, 8, Anglesea Street.

City of Mexico Electric Power Syndicate, Limited (55,438).—Registered December 30th, with capital £5,000 in £50 shares (40 preference), to acquire any rights and grants for producing electricity for lighting, motive, and other purposes in Mexico or elsewhere, and to carry on the business of electrical engineers and contractors. The subscribers (with one share each) are:—H. K. Baynes, 15, Chapel Street, Belgrave Square, S.W., solicitor; F. S. Courtney, C.E., 39, Alleyn Park, Dulwich; J. T. Toomer, C.E., Queen Anne's Mansions, Westminster; T. P. Wilson, C.E, Holmhurst, Belvedere, Kent; A. P. Friend, Ouseley House, Erith, Kent, engineer; R. J. Price, M.P, 104, Sloane Street, S.W.; C. F. Sillem, Broad Sanctuary Chambers, Westminster, engineer. The number of directors is not to be less than three, nor more than five. The first are J. Price, H. K. Baynes, and J. F. Toomer. Registered by Goldring & Hargrove, 99, Cannon Street, E.C.

CITY NOTES.

Kelvinside Electricity Company.

THE annual meeting of this company was held at 28, Renfield Street, Glasgow, on the 29th inst., Mr. J. B. Fleming presiding.

The CHAIRMAN, in moving the adoption of the report, said they had not to report a very flourishing concern. They had no dividend to give, but it was perfectly obvious they had turned the corner, and were not far away from success. Several elements had led to that. Mr. Sharpe had induced a good many people to become users of the light, and he believed that his work would become more apparent in the future. The number of consumers was gradually and steadily increasing, but these were not coming in so rapidly as he could wish.

Mr. RECKETT seconded the motion.

In answer to questions, the CHAIRMAN said they could supply three times the amount of light they were doing at present. The people of Partick were anxious to get the light, and, in addition to householders on the top of the hill, many shopkeepers were desirous of having it. If they had the light in Partick, he was convinced that the company would be a paying concern. He thought they were likely to get the provisional order for Partick, as he did not think the opposition of Glasgow would count for much. He further stated that the revenue this year had been £1,573 11s. 6d., an increase of £151 17s. 8d. over the previous year. The number of units used was 63,562, as compared with 63,467 last year. Although that was only an increase of 95, there was this fact that it included a larger number of private houses, for the cyanide works, which had used a considerable quantity of light in 1895, and rather less last year, would be off this year. The number of units of light sold to private houses was 52,586, against 35,545 in the previous year, showing an increase in that department of nearly 50 per cent

The report was adopted.

Messrs. J. B. Fleming and Reckett were re-elected directors.

Babcock & Wilcox, Limited.

AT an extraordinary general meeting of this company, held on 29th ult., at the Cannon Street Hotel, Sir W. Arrol, M.P., presiding, the resolutions passed on the 14th inst., for increasing the capital of the company to £320,000 by creating 8,000 new ordinary shares of £10 each, to rank *pari passu* with the existing ordinary shares, and to rank for dividend as from the 1st inst., were confirmed as special resolutions, on the motion of the chairman, seconded by Mr. M. Rumley. The chairman, in answer to a question, stated that notices to the shareholders would go out in a day or two, and every preference and ordinary shareholder would be entitled to his fair proportion of the new shares.

London Electric Supply Corporation.—According to the *Daily Mail*, when the accounts of this company are made up for 1897 it is proposed to take the concern out of the receiver's hands, to reconstruct the company, and to reduce the capital by writing off £2 or £3 from the ordinary shares. This would place the corporation on a sound basis. The company is doing a big business, and rapid strides are being made. The dividend on the preferences was earned last year, while there was also a small amount left for the ordinary, so that in future preference holders may expect to receive their 6 per cent. in full.

The City of London Electric Lighting Company, Limited.—Warrants for interest due on 31st ult. on the £400,000 5 per cent. debenture stock have been duly posted.

Electric Construction Company.—The transfer books for the first mortgage debentures will be closed from 8th to 14th inst inclusive.

TRAFFIC RECEIPTS.

The City and South London Railway Company. The receipts for the week ending January 2nd, 1898, were £1,050; week ending January 3rd, 1897 £1,077; decrease, £27; total receipts for half-year, 1898, £1,050; corresponding period, 1897, £1,077; decrease, £27.

The Liverpool Overhead Railway Company. The receipts for the week ending January 2nd, 1898, amounted to £1,357; corresponding week last year, £1,374; decrease, £17.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending December 31st, 1897, after deducting 17 per cent. of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £2,384.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present issue.	NAME,	Stock or Share. ‡	Dividends for the last three years. 1894.	1895.	1896.	Closing Quotation, Dec. 29th.	Closing Quotation, Jan. 5th.	Business done during week ended Jan. 5th, 1898. Highest.	Lowest.
137,400£	African Direct Teleg., Ltd., 4 % Deb.	100	4 %	4 %	...	101 —105	100 - 104 xd	...	...
25,000	Amason Telegraph, Limited, shares...	10	...	...	...	5½ — 6½	5½ — 6½	...	...
923,960£	Anglo-American Teleg., Ltd.	Stock	£2 2s.	£2 9s.	£2 13s.	60 — 62	61 — 63	60½	60¼
3,038,020£	Do. do. 6 % Pref.	Stock	£4 4s.	£4 18s.	£5 6s.	108½ - 109½	110 —111	111	108
3,038,020£	Do. do. Defd.	Stock	...	...	...	13½ — 14	13½ — 14	13 13/16	13 9/16
130,000	Brazilian Submarine Teleg., Ltd.	10	7 %	7 %	...	16 — 16½	16 — 16½	16½	16⅜
75,000£	Do. do. 5 %, Debs., 2nd series, 1926	100	5 %	5 %	...	114 —118	112 — 116 xd	...	...
44,000	Chili Telep., Ltd., Nos. 1 to 44,000	5	2½%	4 %	4 %	3 — 3½	3 — 3½	...	...
10,000,000$	Commercial Cable Co.	$100	7 %	7 %	7 %	183 —188	182 —187 xd	...	...
653,586£	Do. Do. Sterling 500 year 4% Deb. Stock Red.	Stock	...	...	...	105 —107	104 —106 xd	107	105¼
224,850	Consolidated Telep. Const. and Main., Ltd.	10/-	1½%	1½%	2 %	1/4 — 3/8	1/4 — 3/8	...	...
16,000	Cuba Teleg., Ltd.	10	8 %	8 %	8 %	8½ - 9½	8½ - 9½	9½	9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	18½ - 19½	18½ - 19½	...	...
12,931	Direct Spanish Teleg., Ltd.	5	4 %	4 %	4 %	4 — 5	4 — 5	...	...
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 — 11	10 — 11	10⅜	10⅛
30,000£	Do. do. 4½ % Debs. Nos. 1 to 6,000	50	4½%	4½%	4½%	103 —106%	102 —105% xd	...	...
60,710	Direct United States Cable, Ltd.	20	2 %	2½%	2½%	10½— 10⅝	10½— 10⅝	10⅝	10½
400,000	Eastern Teleg., Ltd., Nos. 1 to 400,000	10	6½%	6½%	6½%	17 — 17½	17 — 17½	17½	17 1/16
70,000	Do. 6 % Cum. Pref.	10	6 %	6	6%	18 — 19	18 — 19	18⅛	18½
89,900£	Do. 5 % Debs., repay. August, 1899	100	5 %	5 %	5%	101 104	2 1 5	...	...
1,302,615£	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	4%	130 - 133	130 - 133	133	...
250,000	Eastern Extension, Australasia and China Teleg., Ltd.	10	7 %	7 %	7 %	18½ 18⅝	18½ - 18⅝	18⅝	18½
25,200£	Do. 5 % (Aus. Gov. Sub.), Deb., 1900, red. ann. drgs. reg. 1 to 1,042, 3,976 to 4,326	100	5 %	5 %	5%	101 —1 5	99 - 103 xd	...	...
100,500£	Do. do. Bearer, 1,056—3,975 and 4,327—6,400	100	5 %	5 %	5%	102 —1 5	100 - 103 xd	100½	...
320,000£	Do. 4 % Deb. Stock	Stock	4 %	4 %	4%	132 —1 5	132 - 135	132	...
51,100£	Eastern and South African Teleg., Ltd., 5 % Mort. Deb. 1900 redeem. ann. drgs., Reg. Nos. 1 to 2,343	100	5 %	5 %	5%	101 - 105	99 - 103 xd	100	...
69,200£	Do. do. do. to bearer, 2,344 to 5,500	100	5 %	5 %	5%	102 —1 5	100 —104 xd	102½	...
300,000£	Do. 4 % Mort. Debs. Nos. 1 to 3,000, red. 1909	100	4 %	4 %	4%	103 —106	103 - 106	...	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1 to 8,666	25	4 %	4 %	4%	108 —111%	108 —111 %	...	...
130,227	Globe Telegraph and Trust, Ltd.	10	4½%	4½%	4½%	11½ — 12	11¼— 12	11⅞	11⅝
180,042	Do. do. 6 % Pref.	10	6 %	6 %	6%	17½ - 18	17½ - 18	17⅝	17 1/16
150,000	Great Northern Teleg. Company of Copenhagen	10	8⅝%	10 %	10 %	25½ - 26½	25½ - 26½	26 1/16	...
160,000	Do. do. do. 5 % Debs.	100	5 %	5 %	5 %	102 —105	102 —105	...	...
17,000	Indo-European Teleg., Ltd.	25	10 %	10 %	10 %	52 — 55	52 — 55	55½	...
100,000£	London Platino-Brazilian Teleg., Ltd. 6 % Debs.	100	6 %	6 %	6%	107 —110	107 - 1 0	...	...
28,000	Montevideo Telephone 6% Pref., Nos. 1 to 28,000	5	4 %	4 %	...	2 — 2½	2 — 2½	...	...
484,597	National Teleph., Ltd., 1 to 484,597	5	5 %	5½%	5½%	6½ - 6⅝	6½ - 6⅝	6⅝	6⅝
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	15 - 17	15 — 17	...	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	14 — 16	14 — 16	15¼	...
119,234	Do. 5 % Non-cum. 3rd Pref.. 1 to 119,234	5	5 %	5 %	5 %	6 — 6½	6 — 6½	...	...
130,766	Do. do. Nos. 119,235 to 250,000, £5 paid	5	...	...	...	4⅜— 5¼	5⅜— 6¼	...	...
1,329,471	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	104 —109	102 —107 xd	105½	105
171,504	Oriental Teleph. & Elec., Ltd., Nos. 1 to 171,504, fully paid	1	4½%	5 %	5 %	9/16 11/16	9/16 11/16	...	...
100,000£	Pacific and European Tel., Ltd., 4 % Guar. Debs, 1 to 1,000	100	4 %	4 %	4 %	107 110	105 —108 xd	...	...
11,839	Reuter's Ltd.	8	nil	5 %	5 %	7½ - 8½	7½ - 8½	...	...
3,381	Submarine Cables Trust	Cert.	...	...	...	136 - 141	136 —141	139½	...
58,000	United River Plate Teleph., Ltd.	5	3 %	4 %	...	3⅜ — 4¼	3⅜ — 4¼	...	...
146,733£	Do. do. 5 % Debs.	Stock	5 %	5 %	...	102 —107	100 —105 xd	...	...
15,609	West African Teleg., Ltd., 7,561 to 23,169	10	nil	4 %	nil	4½ - 5½	4½ - 5½	...	...
213,400£	Do. do. do. 5 % Debs.	100	5 %	5 %	5 %	103 —106	103 - 106	...	...
64,256	Western and Brazilian Teleg., Ltd.	15	3 %	3 %	2 %	9⅜ - 10¼	9⅜ — 10½	10 3/16	9⅜
33,129	Do. do. do. 5 % Pref. Ord.	7½	5 %	5 %	5 %	7¼— 7⅜	7¼ — 7⅜	7½	7⅜
33,129	Do. do. do. Def. Ord.	7½	1 %	1 %	...	2⅜ — 3¼	2⅜ — 3¼	...	...
382,230	Do. do. do. 4 % Deb. Stock Red.	Stock	...	...	...	106 —109	104 —107 xd	105⅜	105
88,321	West India and Panama Teleg., Ltd.	10	1%	1%	1 %	⅛ — ¼	⅜ — ½	...	...
34,563	Do. do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	7⅜ — 8¼	7½ — 8	8	7 13/16
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 — 7	5 — 7	...	...
80,000£	Do. do. 5 % Debs. No. 1 to 1,800	100	5 %	5 %	5 %	107 —110	105 —108 xd	...	...
1,163,000$	Western Union of U. S. Teleg., 7 % 1st Mort. Bonds	$1000	7 %	7 %	7%	105 —110	105 —110	...	...
160,100£	Do. do. 6 % Ster. Bonds.	100	6 %	6 %	6%	100 —105	100 —105	...	...

ELECTRICITY SUPPLY COMPANIES.

30,000	Charing Cross and Strand Electy. Supply	5	4½%	5 %	6 %	12½ — 13½	12½ — 13½	13	...
20,000	Do. do. do. do. 4½ % Cum. Pref.	5	...	...	...	6 — 6½	6 — 6½	...	...
26,000	*Chelsea Electricity Supply, Ltd., Ord., Nos. 1 to 10,277	5	5 %	5 %	5 %	10½— 11	10½— 11	10 15/16	10⅜
60,000	Do. do. do. 4½ % Deb. Stock Red.	Stock	...	4½%	4½%	113 —116	112 —114 xd	..	...
40,000	City of London Elec.Lightg. Co., Ltd., Ord. 40,001—80,000	10	5 %	5 %	7 %	26 — 27	26 — 27	26⅜	26⅜
10,000	Do. do. Prov. Certs.	5	...	...	...	25½— 26½	25½— 26½	...	...
40,000	Do. do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	17 — 18	17 — 18	...	...
400,000	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	5 %	5 %	5 %	131 —136	129 — 134 xd	...	...
30,000	County of Lond. & Brush Prov. E. Ltg. Ltd., Ord. 1—30,000	10	...	nil	nil	13½ — 14	13½ — 14	13⅞	13⅝
20,000	Do. do. do. 6% Pref., 40,001—60,000	10	...	6 %	6 %	15½ — 16	15½ — 16	15⅞	15 9/16
10,000	House-to-House Elec. Light Supply, Ord., 101 to 10,100	5	...	...	...	9 — 10	9 — 10	9½	...
10,000	Do. 7 % Cum. Pref.	5	...	...	...	11 — 11½	11 — 11½	...	...
49,900	*Metropolitan Electric Supply, Ltd., 101 to 50,000	10	3 %	4 %	5 %	18½ — 19½	18½ — 19½	18 15/16	18½
12,500	Do. Ord., 50,001—62,500, iss. at £2 prem.	10	...	...	...	18 — 19	18 — 19	18¼	...
220,000.	Do. 4½% first mortgage debenture stock	...	4½%	4½%	4½%	119 — 123	117 —121 xd	117⅝	...
6,452	Notting Hill Electric Lightg. Co., Ltd.	10	1 %	2 %	4 %	17½ — 18½	17½ — 18½	...	...
19,980	*St. James's & Pall Mall Elec. Light Co., Ltd., Ord., 101-20,080	5	6½%	7½%	10½%	17 — 18	17 — 18	17½	17⅝
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	10 — 11	10 — 11	10⅝	...
50,000	Do. do. 4 % Deb. stock Red.	Stock	...	...	...	103 —106	101 —104 xd	...	...
43,341	South London Electricity Supply, Ord., £2 paid	5	...	...	...	2⅝ — 2⅞	2⅝ — 2⅞	2 13/16	2 11/16
79,900	Westminster Electric Supply Corp., Ord., 101 to 80,000	5	5 %	7 %	9 %	16 — 17	16 — 17	16⅝	...

* Subject to Founder's Shares. † Quotations on Liverpool Stock Exchange.

‡ Unless otherwise stated all shares are fully paid. § Dividends paid in deferred share warrants, profits being used as capital.

Dividends marked ‡ are for a year consisting of the latter part of one year and the first part of the next

SHARE LIST OF ELECTRICAL COMPANIES—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL, COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1894.	1895.	1896.	Closing Quotation, Dec. 29th.	Closing Quotation Jan. 5th.	Business done during week ended Jan. 5th, 1898. Highest	Lowest.
30,000	British Electric Traction	10	...	...	...	16⅜ — 17¼	16½ — 17	17⅛	16¼
90,000	Brush Elecl. Engng. Co., Ord., 1 to 90,000...	8	2½%	...	...	1⅞ — 2⅛	1⅞ — 2⅛	2 1/16	...
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000	2	3 %	...	...	2⅛ — 2⅜	2⅛ — 2⅜	2 1/16	2¼
125,000£	Do. do. 4½ % Perp. Deb. Stock.... ...	Stock	4½%	...	...	109 — 113	109 — 113	...	...
50,000	Do. do. 4½% 2nd Deb. Stock Red. ...	Stock	...	...	...	103 — 105	100 — 103xd	...	...
19,126	Central London Railway, Ord. Shares	10	...	...	...	9¾ — 10¼	9¾ — 10¼xd	10	9 13/16
143,106	Do. do. do. £6 paid	10	...	...	...	5½ — 6	5½ — 6xd	5⅞	5⅝
58,830	Do. do. Pref. half-shares £1 pd. ...	...	...	...	...	1 — 1⅛	1⅛ — 1⅜xd	1⅛	1 1/16
61,777	Do. do. Def. do. £5 pd. ...	...	...	...	...	4¼ — 4⅝	4 — 4¼xd	...	...
630,000£	City and South London Railway	Stock	1⅛%	1 1/16%	1 1/16%	66 — 68	67 — 69	69	67
28,180	Crompton & Co., Ltd., 7 % Cum. Pref. Shares, 1 to 28,180	5	*nil*	*nil*	...	2 — 2½	2 — 2½	...	...
99,261	Edison & Swan United Elec. Lgt., Ltd., "A" shrs, £3 pd. 1 to 99,261	5	5 %	5 %	5½%	2½ — 3	2½ — 3	...	...
17,139	Do. do. do. "A" Shares 01—017,139	5	5 %	5 %	5½%	4½ — 5½	4½ — 5½	...	...
110,000	Electric Construction, Ltd., 1 to 110,000	2	*nil*	5 %	6 %	2⅜ — 2⅝	2⅜ — 2⅝	2 1/16	2½
16,343	Do. do. 7 % Cum. Pref., 1 to 16,343 ...	2	7 %	7 %	7 %	3⅜ — 3⅝	3⅜ — 3⅝	...	...
91,195	Elmore's Patent Cop. Deposg., Ltd., 1 to 70,000	2	*nil*	...	...	¾ — ⅞	¾ — ⅞	...	...
67,275	Elmore's Wire Mfg., Ltd., 1 to 69,385, issued at 1 pm. ...	2	*nil*	...	...	¾ — ⅞	¾ — ⅞	...	...
9,600£	Greenwood & Batley, Ltd., 7 % Cum. Pref., 1 to 9,600 ...	10	*nil*	10½%	...	9 — 11	9 — 11	...	...
12,500	Henley's (W. T.) Telegraph Works, Ltd., Ord.	10	6 %	8 %	10 %	20 — 21	20 — 21	21	20¼
3,000	Do. do. do. 7% Pref.	10	7 %	7 %	7 %	18½ — 19½	18½ — 19½	19¼	18½
50,000	Do. do. do. 4½ Mort. Deb. Stock	Stock	...	4½%	4½%	110 —115	110 - 115	112	...
50,000	India-Rubber, Gutta Percha and Teleg. Works, Ltd. ...	10	10 %	10 %	10 %	23 — 24	23½ - 24½	24	23½
300,000	Do. do. do. 4 % 1st Mort. Debs.	100	...	...	...	103 —107	103 —107	...	...
37,500	¶Liverpool Overhead Railway, Ord.	10	1½%	2⅞%	2⅞%	11½ — 11⅝	11 7/16 — 11 9/16	...	...
10,000	¶ Do. do. Pref., £10 paid	10	5 %	5 %	5 %	16 — 16½	16 — 16½	...	...
37,350	Telegraph Constn. and Maintce., Ltd.	12	20 %	15 %	15 %	36 — 39	36 — 39	38½	37½
150,000	Do. do. do. 5 % Bonds, red. 1899	100	5 %	5 %	5 %	102 —105	101 —104xd	105	...
54,000£	Waterloo and City Railway, Nos. 1 to 54,000	10	...	...	...	12½ — 13	12½ — 13xd	12¾	...

Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. ¶ Last dividend paid was 50% for 1890.
Dividends marked § are for a year consisting of the latter part of one year and the first part of the next.
CROMPTON & Co.—The dividends paid on the ordinary shares (which have not a Stock Exchange quotation), are as follows: 1892—0%; 1891—7%; 1890—8%

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

* Birmingham Electric Supply Company, Ordinary of £5 (£4 paid), 7⅞, £5 (fully paid) 11.
Electric Construction Corporation, 6 % Debentures, 104—106.
House-to-House Company, 4½% Debentures of £100, 109—111.
Kensington and Knightsbridge Electric Lighting Company, Limited Ordinary Shares £5 (fully paid) 15—15½; 1st Preference Cumulative 6 %, £5 (fully paid), 8¼—8⅜. Dividend, 1896, on Ordinary Shares 7 %.
London Electric Supply Corporation, £5 Ordinary, 2½—2⅝.
* T. Parker, Ltd., £10 (fully paid), 12¼.
Yorkshire House-to-House Electricity Company, £5 Ordinary Shares fully paid, 8—8½. Dividend for 1896—6 %.

* From Birmingham Share List.

Bank rate of discount 3 per cent. (October 14th, 1897).

THE APPLICATION OF VECTOR ALGEBRA TO ALTERNATING CURRENTS.

By W. G. RHODES, M.Sc., Royal Technical Institute, Salford.

INTRODUCTION.

1. ANY physical quantity which requires for its complete specification data regarding (1) its *magnitude*, (2) its *direction*, and (3) its *sense* along that direction, is called a vector quantity. Quantities which are completely specified when their magnitudes only are given are called *scalar* quantities.

Mass and power are examples of scalar quantites: velocity, acclera-tion, force, electric currents, and electromotive forces are examples of vector quantities.

A vector quantity may be completely represented by a straight line drawn in a particular direction, the sense along the direction being shown by means of an arrow head, and the line containing as many units of length as the quantity to be represented contains units of quantity.

We shall call a line drawn in this way *a vector, e.g.*, the vector, O P (fig. 1), may represent an electric current if its direction is represented

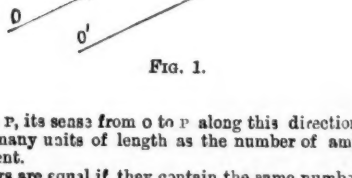


FIG. 1.

by the line O P, its sense from O to P along this direction, and if O P contains as many units of length as the number of amperes in the electric current.

Two vectors are equal if they contain the same number of units of length, are parallel to the same direction, and have the same sense: thus in fig. 1 the vector O P, is equal to the vector $O^1 P^1$, if the length of O P equals that of $O^1 P^1$. The vector P O, we may note, is minus the vector O P.

2. *Composition of Vectors.*—The sum of two vectors, O P and P Q

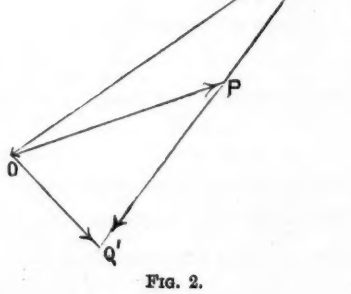


FIG. 2.

(fig. 2), is defined to be the vector O Q. The meaning of the word *sum* is here extended, and if we write

$$O P + P Q = O Q,$$

we should read O P together with P Q are equivalent to O Q. The addition of vectors is thus the same as the addition of forces, for if O P and P Q represent two forces, then O Q represents their resultant. The difference of two vectors, O P and P Q, is defined to be the sum of the two vectors, O P and Q P, and is, therefore, the vector O Q^1 (fig. 2), where P Q^1 = − P Q.

3. *Algebraic Representation of a Vector Quantity.*—Let O P (fig. 3) represent any vector quantity.

Through O draw any two mutually perpendicular lines, x O x^1, y O y^1. Draw P N perpendicular to x O x^1: the two vectors, O N and N P, are then together equal to the vector, O P. Any vector can thus be resolved into two component vectors parallel respectively to x O x^1

and y O y^1. Now let us agree to represent unit vector along O x by $+1$; unit vector along O x^1 will then be represented by -1, since the sense is exactly opposite. Let us further represent unit vector along O y by k; then unit vector along O y^1 will be represented by $-k$. If, then, O N contains a units of length, and N P contains b units, the vector, O P, is represented by $a + k\,b$ and its magnitude is $\sqrt{a^2 + b^2}$: also its inclination to O x is given by $\tan\theta = \frac{b}{a}$. In the same way $-a + k\,b$ represents a vector lying in the quadrant, y O x^1; $-a - k\,b$, one lying in the quadrant, x^1 O y^1; and $a - k\,b$, one lying in the quadrant, y^1 O x.

If P Q (fig. 3) is another vector whose components parallel to O x

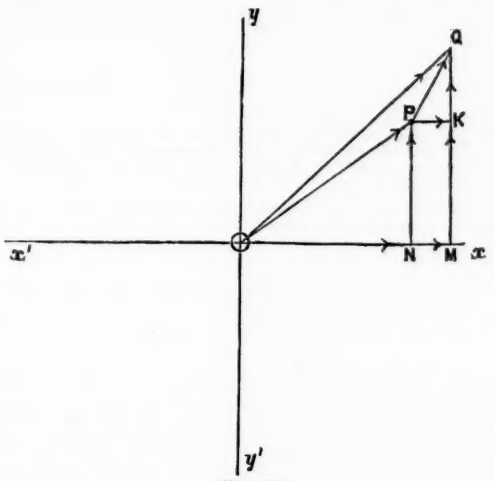


FIG. 3.

and O y are respectively P K = N M = a' and K Q = $b'\,k$, then the vector, P Q, is represented by $a^1 + k\,b^1$, and the vector, O Q, which is the sum of the vectors, O P and P Q, is given by

$$\begin{aligned} \text{O Q} &= \text{O M} + \text{M Q} \\ &= (\text{O N} + \text{N M}) + (\text{M K} + \text{K Q}) \\ &= (a + a') + (k\,b + k\,b') \\ &= (a + a') + k\,(b + b') \end{aligned}$$

This gives the law of vector addition, and inherently contains that of subtraction also, the difference of the vectors, O P and P Q being represented by

$$(a - a') + k\,(b - b').$$

4. *Product of two vectors.*—Consider any two vectors, O P and O Q (fig. 4), and let O P = O N + N P, where N P is at right angles to O Q.

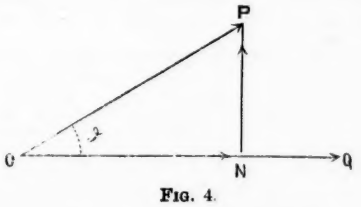


FIG. 4.

There are two products to take into consideration, viz., the product O Q . O N and the product O Q . N P.

To interpret these, suppose that the vector O P represents a displacement, and the vector O Q a force. The product O Q . O N then represents the *work* done by the force in moving its point of application from O to N. This product is essentially scalar.

The product, O Q . N P, represents the *moment* of the force about the point, P, and is a *vector at right angles to the plane*, O P N. We shall not, however, consider this vector product further in the present paper; it is the scalar product, O Q . O N, with which we are at present concerned. By reference to fig. 4, we see that

$$\text{O Q} \,.\, \text{O N} = \text{O Q} \,.\, \text{O P} \cos\theta,$$

so that the scalar product of two vectors is the product of their lengths multiplied by the cosine of the angle between their directions.

5. Let the vector O P be represented algebraically by $a + k\,b$, and the vector O Q by $a' + k\,b'$: then (see fig. 5 and Section 3) the magnitude of O P is $\sqrt{a^2 + b^2}$, that of O Q is $\sqrt{a'^2 + b'^2}$, and the angle, θ, between their directions is

$$\theta = \theta_1 - \theta_2$$

where

$$\tan\theta_1 = \frac{b}{a} \text{ and } \tan\theta_2 = \frac{b'}{a'},$$

therefore,

$$\cos\theta = \cos(\theta_1 - \theta_2) = \cos\theta_1\cos\theta_2 + \sin\theta_1\sin\theta_2.$$

$$= \frac{a}{\sqrt{a^2 + b^2}} \cdot \frac{a'}{\sqrt{a'^2 + b'^2}} + \frac{b}{\sqrt{a^2 + b^2}} \cdot \frac{b'}{\sqrt{a'^2 + b'^2}}$$

that is

$$\sqrt{a^2 + b^2}\ \sqrt{a'^2 + b'^2}\cos\theta = a\,a' + b\,b'.$$

Thus the scalar product of the two vectors $a + k\,b$ and $a' + k\,b'$ is $a\,a' + b\,b'$.

6. *On k as an Operator.*—A vector whose length is a along or parallel to O x is represented by a, whereas a vector of the same length whose direction is parallel to O y is represented by $k\,a$. We

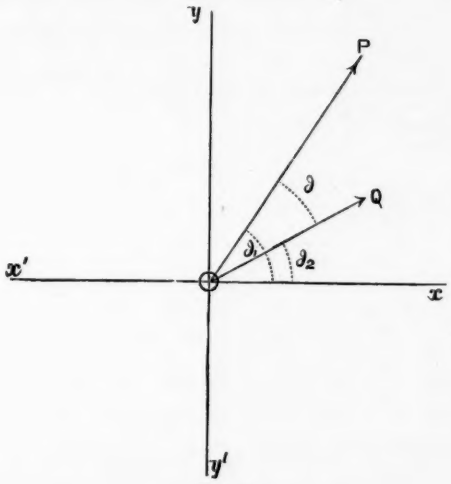


FIG. 5.

may thus regard k as an operator which has the effect of turning a vector along O x, through a right-angle in the positive (counter-clockwise) direction of rotation without altering its length. The effect of similarly operating on $k\,a$ must, therefore, to be consistent, be to turn the vector, $k\,a$, through a right-angle in the positive direction of rotation without altering its length; that is, it becomes a vector of length, a, along O x^1, that is, it becomes $-a$. We thus have

$$k \,.\, k\,a = k^2\,a = -a$$

or

$$k^2 = -1,$$

that is, when using the symbol k in algebraical processes, we must regard it as having the properties of the imaginary $\sqrt{-1}$. If we similarly operate on the vector $-a$, we get $-k\,a$, a vector of length along O y^1, and operating again we get $-k^2\,a$ or $+a$, a vector of length a along O x.

7. Again operating on any vector $a + k\,b$, we get $k\,(a + k\,b)$ or $k\,a - b$, which is the vector $a + k\,b$ turned through a right angle in the positive direction. That is, if O P is any vector, then k . O P is the vector resulting from a rotation of the vector O P through a right angle in the positive direction of rotation. By similar reasoning we can show that $-k$. O P represents the vector resulting from a rotation of the vector O P through a right angle in the negative (clockwise) direction of rotation.

8. *Definition.*—A vector O P is said to lead before, or lag behind, a vector O Q, according as the least amount of rotation necessary to bring O P into the same direction as O Q is in the negative or positive direction.

It is easily seen, then, that the vector, k . O P, leads before the vector, O P, by a right angle, while the vector $-k$. O P lags behind the vector O P by a right angle.

APPLICATION TO ALTERNATING CURRENTS.

9. Before proceeding to apply the foregoing principles to alternating current calculations, we must first establish three important propositions.

Proposition 1.—The maximum value of the induced electromotive force, due to self-induction in a circuit, is p L i, where i is the maximum value of the current in the circuit, L is the self-induction of the circuit, and $p = 2\pi n$, where n is the frequency of the current. Also the E.M.F. of self-induction *lags a right angle behind the current.*

Let the current be $i \sin p\,t$, then the E.M.F. of self-induction is given by

$$\begin{aligned} e &= -\text{L}\frac{d}{d\,t} \,.\, i\sin p\,t \\ &= -p\,\text{L}\,i\cos p\,t \\ &= p\,\text{L}\,i\sin\left(p\,t - \frac{\pi}{2}\right) \end{aligned}$$

which proves the proposition.

Proposition 2.—If two circuits, A and B, have a mutual induction M, the maxima values of the consequent E.M.Fs. in the circuits A and B are respectively p M i_2 and p M i_1, where i_1 is the maximum value of the current in the circuit A, and i_2 that in the circuit B, and these induced E.M.Fs. lag a right angle behind the currents i_2 and i_1 respectively.

Let the current in the circuit, B, be $i_2 \sin p t$, then the E.M.F. in the circuit due to mutual induction is given by

$$e = - \text{M} \frac{d}{d t} \cdot i_2 \sin p t$$
$$= - p \text{M} i_2 \cos p t$$
$$= p \text{M} i_2 \sin \left(p t - \frac{\pi}{2} \right).$$

Similarly for the E.M.F. of mutual induction in the circuit, A. Thus the proposition is established.

Proposition 3.—If a condenser of capacity C is placed in an alternating current circuit, there is a consequent E.M.F. whose maximum value is $\frac{i}{p \text{C}}$, where i is the maximum value of the current flowing through the circuit, and this capacity E.M.F. *leads before the current* by a right angle.

Let q be the charge on the condenser at any instant when the current is $i \sin p t$, then the potential difference at its terminals at that instant is $- \frac{q}{\text{C}}$, but we have

$$q = \int i \sin p t \, d t = - \frac{i}{p} \cos p t.$$

Therefore, the capacity E.M.F. is given by

$$e = - \frac{q}{\text{C}}$$
$$= \frac{i}{p \text{C}} \cos p t$$
$$= \frac{i}{p \text{C}} \sin \left(p t + \frac{\pi}{2} \right),$$

which shows that e leads a right angle before i, and that its maximum value is $\frac{i}{p \text{C}}$. The foregoing three propositions will be in constant demand in the sequel so that they should be thoroughly understood.

10. The method of represent alternating currents and E.M.Fs. by by means of so-called clock diagrams has been so fully dealt with by Dr. Fleming, Mr. Kapp, and other writers on the subject, as to render further explanation of the method here unnecessary; suffice it to say, that if the vector, O P (see fig. 3), is drawn of such a length as to represent in magnitude the *maximum* value of an alternating current or electromotive force, and if it is caused to rotate about O with a uniform angular velocity, p, in the positive direction of rotation, then the vectors, O N and N P, will represent the instantaneous values according as the current or E.M.F. is zero, and increasing *positively* when O P coincides in direction with O y^1 or O x.

CIRCUITS CONTAINING RESISTANCE AND SELF-INDUCTION ONLY.

11. Now let O P $= i$ be a vector representing the maximum current in any circuit containing self-induction, then by Proposition (1) and Section 8, the vector representing the maximum value of the E.M.F. of self-induction in the circuit in which the current, i, is flowing is $- k p \text{L} i$, where L is the self-induction and $p = 2 \pi n$, n being the frequency of the current. If the current is caused by a potential difference whose maximum value is represented by a vector, e, then the vector, e, has to supply a component, $r i$, in the direction of the

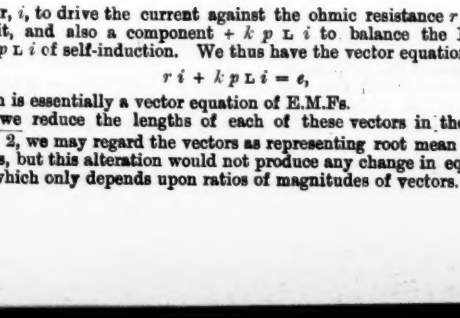


FIG. 6.

vector, i, to drive the current against the ohmic resistance r of the circuit, and also a component $+ k p \text{L} i$ to balance the E.M.F. $- k p \text{L} i$ of self-induction. We thus have the vector equation

$$r i + k p \text{L} i = e, \qquad (1)$$

which is essentially a vector equation of E.M.Fs.

If we reduce the lengths of each of these vectors in the ratio, $1 : \sqrt{2}$, we may regard the vectors as representing root mean square values, but this alteration would not produce any change in equation (1), which only depends upon ratios of magnitudes of vectors.

If then a potential difference, e, of frequency, n, is applied between the terminals of an inductive circuit of resistance, r, and self-induction, L, then the vector equation (1) holds good, p being equal to $2 \pi n$.

Let O P (fig. 6) represent the vector $r i$, then the vector O Q$^1 = - k p \text{L} i$ represents the E.M.F. of self-induction, and the vector P Q $= + k p \text{L} i$ is the vector representing the E.M.F. necessary to overcome self-induction: therefore, the vector O Q $=$ O P $+$ P Q is the vector representing the applied potential difference e. Further, the vector O P, which is in phase with the current, lags behind the vector representing e by an angle θ, where

$$\tan \theta = \frac{p \text{L}}{r}.$$

Also (see Section 3) the *magnitude* of e is given by

$$e = \sqrt{r^2 i^2 + p^2 \text{L}^2 i_2}$$
$$= i \sqrt{r^2 + p^2 \text{L}^2}$$

that is

$$i = \frac{e}{\sqrt{r^2 + p^2 \text{L}^2}} \qquad (2)$$

Equation (2), it must be noticed, is not the same as equation (1); it is one of several deductions from equation (1). Whereas (1) is a *vector* equation, involving directions as well as magnitudes; (2) involves magnitudes only.

The quantity $\sqrt{r^2 + p^2 \text{L}^2}$ is called the impedance of the circuit.

12. Referring again to equation (1), it may be written

$$i (r + k p \text{L}) = e$$

or

$$i = \frac{e}{r + k p \text{L}}$$
$$= \frac{e (r - k p \text{L})}{(r + k p \text{L}) (r - k p \text{L})}$$
$$= \frac{e (r - k p \text{L})}{r^2 + p^2 \text{L}^2}$$
$$= \frac{r}{r^2 + p^2 \text{L}^2} \cdot e - \frac{p \text{L}}{r^2 + p^2 \text{L}^2} \cdot k e, \qquad (3)$$

which is a current vector equation, and states that the current, i, can be resolved into a component $\frac{r}{r^2 + p^2 \text{L}^2} \cdot e$ parallel to the direction of e, and a lagging component $\frac{p \text{L}}{r^2 + p^2 \text{L}^2} (- k e)$ at right-angles to the direction of e. This is shown graphically in fig. 7, where O P is the

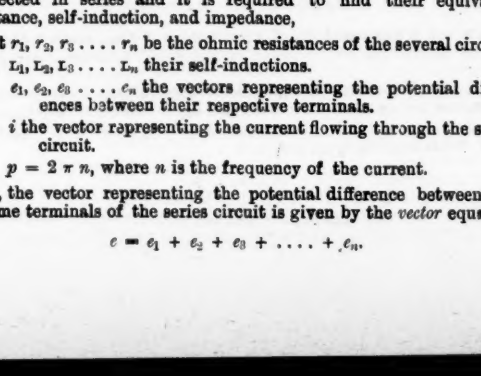


FIG. 7.

current vector, and O Q and Q P its components respectively along and at right angles to the direction of e. It should be noticed that the product $(r + k p \text{L}) (r - k p \text{L})$, which equals $r^2 + p^2 \text{L}^2$, since $k^2 = - 1$, is not a vector product: the quantities, r, p, and L, are all scalar and have no right whatever to be treated as vectors after the manner of some writers on the subject.

We shall frequently make use of the vector equations (1) and (3) so they should be thoroughly understood. In fact, to proceed further without first mastering them would be useless.

13. Suppose now that any number, n, of inductive circuits are connected in series and it is required to find their equivalent resistance, self-induction, and impedance,

Let $r_1, r_2, r_3 \ldots r_n$ be the ohmic resistances of the several circuits.

" $\text{L}_1, \text{L}_2, \text{L}_3 \ldots \text{L}_n$ their self-inductions.

" $e_1, e_2, e_3 \ldots e_n$ the vectors representing the potential differences between their respective terminals.

" i the vector representing the current flowing through the series circuit.

" $p = 2 \pi n$, where n is the frequency of the current.

Then, the vector representing the potential difference between the extreme terminals of the series circuit is given by the *vector* equation

$$e = e_1 + e_2 + e_3 + \ldots + e_n.$$

But by equation (1)

$$e_1 = r_1 i + k p L_1 i$$
$$e_2 = r_2 i + k p L_2 i$$
$$e_3 = r_3 i + k p L_3 i$$
$$\cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot$$
$$\cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot$$
$$e_n = r_n i + k p L_n i.$$

Now all the r i's are in the same direction, viz, along the current vector, as also are all the $k p L i$'s, viz., leading a right angle in front of the current vector; they can, therefore, be added together numerically, and we get

$$e = e_1 + e_2 + e_3 + \ldots + e_n$$
$$= (r_1 + r_2 + r_3 + \ldots + r_n) i +$$
$$k p (L_1 + L_2 + L_3 + \ldots + L_n) i \qquad (4)$$

But if R and L are the equivalent resistances and self-inductions of the complete circuit, we have by equation (1)

$$e = R i + k p L i \qquad (5)$$

Comparing equations (4) and (5) we see that

$$R = r_1 + r_2 + r_3 + \ldots + r_n$$

and

$$L = L_1 + L_2 + L_3 + \ldots + L_n$$

and the impedance, I, is given by

$$I = \sqrt{R^2 + p^2 L^2}.$$

(To be continued.)

ELECTRIC LIGHTING PROVISIONAL ORDERS.—SESSION 1898.

LIST of applications for provisional orders deposited with the Board of Trade, on or before December 21st, 1897, under the provisions of the Electric Lighting Acts, 1882 to 1890.

Title of order and description of area.	Name of promoters.	Agents.
Airdrie Burgh Electric Lighting Order. The Burgh of Airdrie.	The Corporation.	Messrs. Martin and Leslie, 27, Abingdon Street, Westminster, S.W.
Aldershot Electric Lighting Order. The Urban District of Aldershot.	The Urban District Council.	Messrs. Blyth, Dutton, Hartley and Blyth, 112, Gresham House, Old Broad Street, E.C.
Aston Manor Electric Lighting Order. The Urban District of Aston Manor.	The Urban District Council.	Messrs. Sharpe & Co., 9, Bridge Street, Westminster, S.W.
Barnes Electric Lighting Order. The Urban District of Barnes.	The Urban District Council.	T. Blanco White, Esq, 59 and 60, Chancery Lane, W.C.
Batley Electric Lighting Order. The Borough of Batley.	The Corporation.	Messrs. Dyson & Co., 9, Great George Street, Westminster, S.W.
Birkdale Electric Lighting Order. The Urban District of Birkdale.	The Urban District Council.	Messrs. Sharpe & Co., 9, Bridge Street, Westminster, S.W.
Bolton Electric Lighting Order. The County and Municipal Borough of Bolton, the Urban District and Township of Astley Bridge, and the Townships of Heaton, Smithills, Darcy Lever, Breightmet, Lostock, Deane - over - Hulton, Middle Hulton, Tonge, and Great Lever, within the Bolton Rural District.	The Corporation of Bolton.	Messrs. Dyson & Co., 9, Great George Street, Westminster, S.W.
Brechin Electric Lighting Order. The Royal Burgh of Brechin.	The Corporation.	Messrs. Clarkson and Toovey, 98, Great Tower Street, E.C.
Bridgwater Corporation Electric Lighting Order. The Borough of Bridgwater.	The Corporation.	Messrs. Torr & Co., 19, Abingdon Street, Westminster, S.W.
Burslem Electric Lighting Order. The Borough of Burslem.	The Corporation.	Messrs. Sharpe & Co., 9, Bridge Street, Westminster, S.W.
Chelmsford Rural District Electric Lighting Order. The Parishes of Writtle, Great Baddow, Broomfield, Springfield and Widford, within the Chelmford Rural District.	Chelmsford Electric Lighting Company, Ltd.	Messrs. Deacon and Co., 9, Great St. Helen's, E.C.
Chichester Corporation Electric Lighting Order. The City of Chichester.	The Corporation.	Messrs. Baker & Co., 22, Great George Street, Westminster, S.W.
Chislehurst Electric Lighting Order. Portion of the Parish of Chislehurst.	Chislehurst Electric Supply Company, Limited.	Messrs. Baker, Blaker & Hawes, 117, Cannon Street, E.C.
Chorley Corporation Electric Lighting Order. The Borough of Chorley.	The Corporation.	Messrs. Lewin, Gregory & Anderson, 13, King Street, Whitehall, S.W.
Colne Corporation Electric Lighting Order. The Municipal Borough of Colne.	The Corporation.	Messrs. Baker & Co., 23, Great George Street, Westminster, S.W.
Crewe Electric Lighting Order. The Borough of Crewe.	The Corporation.	Messrs. Sharpe & Co., 9, Bridge Street, Westminster, S.W.
Darlington Electric Lighting Order. The whole of the Borough of Darlington, except the detached portion of the Township or Civil Parish of Darlington known as Oxen-le-Field.	The Corporation.	Messrs. Durnford and Co., 38, Parliament Street, Westminster, S.W.
Dartford Electric Lighting Order. The Urban District of Dartford.	The Urban District Council.	Messrs. Baker & Co., 22, Great George Street, Westminster, S.W.
Doncaster Corporation Electric Lighting Order. The Borough of Doncaster.	The Corporation.	Messrs. Sherwood and Co., 7, Great George Street, Westminster, S.W.
East Ham Electric Lighting Order. The Urban District of East Ham.	The Urban District Council.	Messrs. Baker & Co., 22, Great George Street, Westminster, S.W.
East Stonehouse Electric Lighting Order. The Urban District of East Stonehouse.	The Urban District Council.	Do.
Gravesend Electric Lighting Order. The Municipal Borough of Gravesend.	The Corporation.	Messrs. Deacon and Co., 9, Great St. Helen's, E.C.
Greenock, Port-Glasgow, and Gourock Electric Lighting Order. The Burghs of Greenock, Port-Glasgow, and Gourock.	North British Electricity Supply Company, Ltd.	Messrs. Sherwood and Co., 7, Great George Street, Westminster, S.W.
Hamilton Electric Lighting Order. The Burgh of Hamilton.	The Corporation.	Messrs. Grahames, Currey & Spens, 30, Great George Street, Westminster, S.W.
Hastings Corporation Electric Lighting Order. The Borough of Hastings	The Corporation.	Messrs. Bircham and Co., 46, Parliament Street, Westminster, S.W.
Hereford Electric Lighting Order. The City of Hereford.	The Corporation.	Messrs. Andrews and Fawcus, 18, Essex Street, Strand, W.C.
Hornsey Electric Lighting Order. The Urban District of Hornsey.	The Urban District Council	Leonard J. Tatham, Esq., 17, Bedford Row, W.C.
Hove (Aldrington) Electric Lighting Order. The Parish of Aldrington in the town of Hove.	The Hove Urban District Council.	Messrs. Bircham and Co., 46, Parliament Street, Westminster, S.W.
Ilford Electric Lighting Order. The Urban District of Ilford.	The Urban District Council.	John W. Benton, Esq., Clerk to the Council, 3, Cranbrook Road, Ilford.
Ilfracombe Electric Lighting Order. The Urban District of Ilfracombe.	The Urban District Council.	Messrs. Baker & Co., 22, Great George Street, Westminster, S.W.
King's Norton Electric Lighting Order. The Parishes of King's Norton and Northfield in the Rural District of King's Norton.	The Rural District Council.	Messrs. Bircham and Co., 46, Parliament Street, Westminster, S.W.
Kingswinford Electric Lighting Order. The Rural District of Kingswinford.	The Rural District Council.	Messrs. Baker & Co., 22, Great George Street Westminster, S.W.
Leatherhead Electric Lighting Order. The Urban District of Leatherhead.	The Urban District Council.	Messrs. Sherwood and Co., 7, Great George Street, Westminster, S.W.

Title of order and description of area.	Name of promoters.	Agents.
Leigh-on-Sea Electric Lighting Order. The Urban District of Leigh-on-Sea.	The Urban District Council.	Messrs. R. W. Cooper & Sons, 5, Victoria Street, S.W.
Lewes Corporation Electric Lighting Order. The Borough of Lewes.	The Corporation.	Messrs. Renshaw, Kekewich, & Smith, 2, Suffolk Lane, Cannon Street, E.C.
Lowestoft Electric Lighting Order. The Borough of Lowestoft.	The Corporation.	Messrs. Sharpe & Co., 9, Bridge Street, Westminster, S.W.
THE COUNTY OF LONDON:		
Bermondsey Electric Lighting Order. The Parish of Bermondsey.	The Vestry.	Frederick Ryall, Esq., Town Hall, Spa Road, Bermondsey, S.E.
Bermondsey, Rotherhithe, Greenwich, and Lewisham Electric Lighting Order. The Parishes of Bermondsey and Rotherhithe and the Districts of Greenwich and Lewisham.	County of London and Brush Provincial Electric Lighting Company, Limited.	Sydney Morse, Esq., 4, Fenchurch Avenue, E.C.
Bethnal Green, Poplar, and Whitechapel Electric Lighting Order. The Parish of Bethnal Green and the Districts of Poplar and Whitechapel.	County of London and Brush Provincial Electric Lighting Company, Limited.	Sydney Morse, Esq., 4, Fenchurch Avenue, E.C.
Holborn District Electric Lighting Order. Portion of the Holborn District.	Charing Cross and Strand Electricity Supply Corporation, Ltd.	Messrs. Wyatt and Co., 28, Parliament Street, Westminster, S.W.
Holborn and St. Giles Electric Lighting Order. Portion of the Holborn District, the District of St. Giles, Lincoln's Inn, Gray's Inn, Staple Inn, and Furnival's Inn.	County of London and Brush Provincial Electric Lighting Company, Limited.	Sydney Morse, Esq., 4, Fenchurch Avenue, E.C.
Lewisham District Electric Lighting Order. The District of Lewisham.	The District Board of Works.	Templer L. Down, Esq., 3, Pope's Head Alley, Cornhill, E.C.
Lewisham Electric Lighting Order. Portion of the Parish of Lewisham.	Great Western Electric Light and Power Company, Limited.	Messrs. Walter Webb and Co., 23, Queen Victoria Street, E.C.
St. Giles District Electric Lighting Order. The District of St. Giles.	Charing Cross and Strand Electricity Supply Corporation, Ltd.	Messrs. Wyatt and Co., 28, Parliament Street, Westminster, S.W.
St. Marylebone Electric Lighting Order. The Parish of St. Marylebone.	The Vestry.	Messrs. Sherwood and Co., 7, Great George Street, Westminster, S.W.
St. Marylebone Electric Lighting Order. The Parish of St. Marylebone.	County of London and Brush Provincial Electric Lighting Company, Limited.	Messrs. Milner & Bickford, 1, Great Tower Street, E.C.
St. Marylebone Electric Lighting Order. The Parish of St. Marylebone.	Marylebone Electric Supply Company, Limited.	Sydney Morse, Esq., 4, Fenchurch Avenue, E.C.
Maidenhead Electric Lighting Order. The Borough of Maidenhead.	The Corporation.	Messrs. Sharpe & Co., 9, Bridge Street, Westminster, S.W.
Margam Electric Lighting Order. The Urban District of Margam.	The Urban District Council.	Messrs. Baker & Co., 22, Great George Street, Westminster, S.W.
Melton Mowbray Electric Lighting Order. The Urban District of Melton Mowbray and the Parishes of Sysonby, Welby, Eye Kettleby, Burton Lazars, and Thorpe Arnold, in the Rural District of Melton Mowbray.	Melton Mowbray Electric Light Co., Limited.	Messrs. Rees & Frere, 5, Victoria Street, Westminster, S.W.
Middlesbrough Corporation Electric Lighting Order. The Municipal Borough of Middlesbrough.	The Corporation.	Messrs. Durnford & Co., 38, Parliament Street, Westminster, S.W.
Midland Electric Power Distribution and Lighting Order. The Boroughs of Walsall, Wednesbury, West Bromwich, and Wolverhampton, the Urban Districts of Bilston, Coseley, Darlaston, Heath Town, Rowley Regis, Sedgley, Short Heath, Smethwick, Tipton, Wednesfield, and Willenhall, and the Rural District of Walsall, in the County of Stafford; and the Borough of Dudley, and the Urban District of Oldbury, in the County of Worcester.	Midland Electric Corporation for Power Distribution, Limited.	Messrs. Sherwood and Co., 7, Great George Street, Westminster, S.W.
Michelstown Electric Lighting Order. The Town of Michelstown.	The Michelstown Guardians.	Messrs. W. and W. M. Bell, 27, Great George Street, Westminster, S.W.
Montrose Electric Lighting Order. The Royal Burgh of Montrose.	The Corporation.	Messrs. Clarkson and Toovey, 98, Great Tower Street, E.C.
Norwich (Extension) Electric Lighting Order. The Parishes of Thorpe St. Andrew, Postwick, Sprowston, Old Catton, Hellesdon, Costessey, Bowthorpe, Colney, Cringleford, Intwood, Keswick, Markshall, Arminghall, Trowse Newton, and Bixley, and and the Shirehall and Castle Ditches, Norwich.	Norwich Electricity Company, Limited.	Messrs. Waterhouse and Co., 1, New Court, Lincoln's Inn, W.C.
Nuneaton Electric Lighting Order. Portions of the Parishes of Nuneaton and Chivers Coton.	Nuneaton Electric Company, Ltd.	Cecil F. Twist, Esq., 5, Bedford Row, W.C.
Oldbury Electric Lighting Order. The Urban District of Oldbury.	The Urban District Council.	Messrs. R. W. Cooper and Sons, 5, Victoria Street, S.W.
Ossett Electric Lighting Order. The Municipal Borough of Ossett.	The Corporation.	Messrs. Baker & Co., 22, Great George Street, Westminster, S.W.
Partick Electric Lighting Order. The Burgh of Partick.	Kelvinside Electricity Company, Limited.	Messrs. Burchell and Co., 5, The Sanctuary, Westminster, S.W.
Penarth Electric Lighting Order. The Urban District of Penarth.	Penarth Electric Lighting Company, Limited.	J. C. Ball, Esq., 3, Victoria Street, Westminster, S.W.
Perth Electric Lighting Order. The Parliamentary Burgh of Perth.	The Commissioners of the Burgh.	Messrs. Wm. Robertson & Co., 45, Parliament Street, Westminster, S.W.
Peterborough Electric Lighting Order. The Municipal Borough of Peterborough.	Peterborough Electric Light and Power Company, Limited.	Messrs. Clarkson and Toovey, 98, Great Tower Street, E.C.
Prescot District Electric Lighting Order. The Urban District of Huyton-with-Roby.	British Insulated Wire Company, Limited.	Sidney Morse, Esq., 4, Fenchurch Avenue, E.C.
Preston (Extensions) Electric Lighting Order. The Urban District of Fulwood, and the Townships of Broughton, Lea Ashton Ingol and Cotam, Woodplumpton, Barton, and Penworthan, in the Rural District of Preston.	National Electric Supply Company, Limited.	Francis H. White, Esq., 7, Bedford Row, W.C.
Ramsgate Electric Lighting Order. The Borough of Ramsgate.	Electric Supply Corporation, Ltd.	Messrs. Deacon and Co., 9, Great St. Helen's, E.C.
Rawmarsh Electric Lighting Order. The Urban District of Rawmarsh.	The Urban District Council.	Messrs. Baker & Co., 22, Great George Street, Westminster, S.W.
Rochdale Electric Lighting Order. The County Borough of Rochdale.	The Corporation.	Messrs. Dyson & Co., 9, Great George Street, Westminster, S.W.

Title of order and description of area.	Name of promoters.	Agents.
Rotherham Corporation Electric Lighting Order. The Municipal Borough of Rotherham.	The Corporation.	Messrs. Baker & Co., 22, Great George Street, Westminster, S.W.
Rothesay Electric Lighting Order. The Burgh of Rothesay.	The Corporation.	Messrs. Loch & Co., 36, Great George Street, S.W.
Royal Leamington Spa Electric Lighting Order. The Borough of Royal Leamington Spa.	The Corporation.	Messrs. Sharpe & Co., 9, Bridge Street, Westminster, S.W.
Royal Leamington Spa Electric Light and Power Order. The Borough of Royal Leamington Spa.	Midland Electric Light and Power Company, Ltd.	Messrs. Smith, Pinsent & Co., 6, Bennett's Hill, Birmingham.
Ryde Electric Lighting Order. The Borough of Ryde.	Ryde Electric Light and Power Company, Ltd.	Messrs. Clarkson and Toovey, 98, Great Tower Street, E.C.
St. Albans Corporation Electric Lighting Order. The City of St. Albans.	The Corporation.	Messrs. Rees and Frere, 5, Victoria Street, Westminster, S.W.
St. Anne's-on-the-Sea Electric Lighting Order. The Urban District of St. Anne's-on-the-Sea.	The Urban District Council.	Messrs. Baker & Co., 22, Great George Street, Westminster, S.W.
Shrewsbury Electric Lighting Order. The Borough of Shrewsbury.	The Corporation.	Messrs. Sharpe & Co., 9, Bridge Street, Westminster, S.W.
Smethwick Electric Lighting Order. The Urban District of Smethwick.	The Urban District Council.	Messrs. R. W. Cooper and Sons, 5, Victoria Street, Westminster, S.W.
Stoke-upon-Trent Electric Lighting Order. The Borough of Stoke-upon-Trent.	The Corporation.	Messrs. Sharpe & Co., 9, Bridge Street, Westminster, S.W.
Warrington Electric Lighting Order. The Municipal Borough of Warrington.	The Corporation.	Messrs. Baker & Co., 22, Great George Street, Westminster, S.W.
West Bromwich Corporation Electric Lighting Order. The County Borough of West Bromwich.	The Corporation.	Messrs. R.W. Cooper, and Sons, 5, Victoria Street, Westminster, S.W.
Westgate-on-Sea Parish Electric Lighting Order. The Parish of Westgate-on-Sea.	The Isle of Thanet Rural District Council.	R. E. H. Fisher, Esq., 9, New Inn, Strand, W.C.
Weston-super-Mare Electric Lighting Order. The Urban District of Weston-super-Mare.	Weston-super-Mare Electric Light and Power Syndicate.	Messrs. Robbins, Billing & Co., Surrey House, Victoria Embankment, W.C.
Weymouth and Melcombe Regis Electric Lighting Order. The Borough of Weymouth and Melcombe Regis.	The Corporation.	Messrs. Dyson & Co., 9, Great George Street, Westminster, S.W.
Whiston Rural District Electric Lighting Order. The Rural District of Whiston.	The Rural District Council.	Sydney Morse, Esq., 4, Fenchurch Avenue, E.C.
Willesden Electric Lighting Order. The Parish of Willesden.	The Urban District Council.	Messrs. Holmes, Greig & Greig, 18, Abingdon Street, Westminster, S.W.

ON THE EXTERNAL FIELD OF HELICALLY MAGNETISED RINGS.*

BY W. M. MORDEY.

ON the subject of some experiments by the present writer relating to drag on armature conductors, enclosed or nearly enclosed in iron, Prof. H. du Bois contributed an article in the *Electrotechnische Zeitschrift* of August 19th last, in the course of which attention was particularly directed to a phenomenon of ring magnets. Prof. du Bois writes:—"*A ring-magnet experiences a side thrust when in an external field whose lines of force are in the same plane as the ring; and conversely it exerts a thrust in the opposite direction upon the supporter of the external field.*" "This deduction," he adds, "so astonishing at first sight, I have proved to be verified by experiment." As its author gives the emphasis of italics to this passage, it may be well to submit what appears to be the explanation, as the present writer chanced to come across the effect in question a good many years ago. It is, as Prof. du Bois says, rather astonishing at first sight, but the explanation seems to be quite simple. The external field is caused by the advancing or longitudinal constituent of the helix. Magnetically a helix traversed by current acts as a series of rings, but, in addition, it has a minor magnetising effect, at right angles to that of the rings, due to the advance of the conductor from end to end of the helix. Thus, a helix bent into a ring or wound about an annular core, forms an endless or ring-magnet when traversed by current. But in addition to this main effect, the faces of the ring, regarded axially, present N. and S. polarity respectively, the whole closed helix acting externally (so far as this subsidiary effect is concerned), and as regards external fields, as a simple loop or ring of conductor carrying current. This may be illustrated by a lines-of-force figure, taken from a ring helically wound with a single layer of winding. In such a figure, the lines of force radiate from the centre or axis of the ring at right angles to the axis of the spiral—they represent portions of closed lines of force which enclose the axis of the spiral. In a helix wound with two layers, one forward, the other back, the external magnetising effect due to this cause is *nil*. In a single layer (or simple) helix, this external effect may be neutralised by returning the wire along the axis of the helix.

A simple straight helix acts externally as a straight conductor.

A flat spiral acts like a disc or wheel, or as a number of radial conductors in one plane traversed by current passing from or to the centre.

* From the *Philosophical Magazine* for December, 1897.

UNIONISM IN 1851.

Engineering has been raking up records of the old unionism which it has lately been the habit to extol as something very superior to the new unionism. Our contemporary shows clearly that in the year 1851 matters were much as they are to-day. A manifesto of December 24th, 1851, is quoted. It might have been penned by Mr. Barnes. Interference with, or dictation to employers, is specially disclaimed, but overtime and piecework is demanded to be abolished, and there are the stock arguments as to the injury to health and the interference with the intellectual and moral growth of the men.

There was a lockout in 1852. This was the immediate outcome of a Masters' Federation, resulting from an attempt to compel an Oldham firm to abolish piecework, and to stop the working by one man of more than one machine, and also to stop unskilled labour. The lockout was announced for January 10th, 1852, the strike having taken place on January 1st.

In every detail the dispute proceeded on all fours with the present one, save that the Employers' Federation only re-engaged men who would forswear the union, and the union was fairly well smashed, the lockout lasting until April. All its funds had gone, but it lost few members, only some 200 between January and June of 1852, though by the end of the year its members had fallen off by about 2,000, or, say, 20 per cent. The same demands by the men, and the same examples of interference, seemed to characterise this earlier strike, and the special vigour of the attack upon employers caused them to combine. But what was the final result? In 1855 the A.S.E. was again as strong as ever, but the Employers' Federation had perished of atrophy, its units reverting to their state of selfish isolation. Thus it was that in 1872 the plan of crushing employers in detail was enabled to secure victory.

Our contemporary quotes "The strong man armed keepeth his goods in peace," and the unionists know this, and have kept the fact in view for 50 years, keeping their eye for ever on the goal, undiverted by victory or defeat. In 1851 they snatched for a prize and missed it. In 1872 they got their prize. They have probably missed their game this time, but if the employers disband, they will surely try again. But things to-day have one great difference. Foreign competition is now with us. Previously it has been an entirely negligible quantity. It is so no longer, and it is to foreign competition acting on the employers that federation has been brought about. The objections in the past to the men's interference have been based on the difficulty of securing correspondingly increased prices for manufactures. But the increased price had to be paid, and was paid. To-day the increased price cannot be asked, but the foreigner will get the work. Hence the Federation, and the certainty that no longer can the policy of dawdling over work be carried on. The operation and details of the present strike may resemble those of 1851-2, but the environment is now changed, and though eight hours will come about in its proper time, it will not be before workmen understand the necessity of maintaining output—not of keeping it down.

A NEW TRANSMISSION DYNAMOMETER.*

BY W. E. DALBY, M.A., B.Sc., Assoc.M.Inst.C.E.

IN transmission dynamometers in which the deformation of a spring was used to measure the work being transmitted, the mechanism might be divided into two parts: (1) The measuring-springs, and the apparatus fixing them to the several parts of the dynamometer; and (2) the apparatus used to measure the deformation of the spring. The paper treated of a new device for measuring the deformation of the spring.

* Institution of Civil Engineers, December 21st, 1897.

The deformation of the spring was in general communicated to two pieces of the dynamometer, causing relative angular displacement between them. Thus, if one end of the spring was fixed to a pulley and the other end to the shaft on which the pulley was mounted, the relative angular displacement would be between the pulley and the shaft. To measure this whilst the pulley and shaft were rotating, a sprocket-wheel was fixed to the pulley and another of equal diameter to the shaft. Over these an endless band was placed, arranged to form two loops, the parts of the band forming one loop leading the one to the sprocket-wheel and the other to the opposite side of the other sprocket-wheel. In these loops were placed guide-pulleys, mounted in frames, constrained by a slide to move in the direction of the band. A relative angular displacement of the sprocket-wheels was necessarily accompanied by a relative linear displacement of the guide-pulleys in the loops proportional to the torque acting between the shaft and pulley, and by suitably calibrating a scale to measure their distance apart this torque, or change in torque, might be read off directly.

To obtain a good fit, and yet at the same time avoid any sticking of the slide, the frame carrying the guide-pulleys had only six properly arranged points of contact with a group of three bars forming the slide, and to control the motion of the pulleys in any position and constrain them to follow the motion of the loops, a spring was arranged to act on a cord connecting the two frames in such a way that the guide-pulleys were always compelled to sit in their respective loops, the tension on the spring causing them to do so, being constant.

Two dynamometers had been made on these principles for the engineering laboratory at Cambridge. One was arranged on a main driving shaft, the dynamometer being formed by connecting a pulley driving a dynamo to the shaft by means of a spring, a sprocket-wheel was fixed to the shaft, and another of equal diameter was fixed to the pulley-boss. An endless steel band passed over the sprocket-wheels so as to form the loops described was used to operate two guide-pulleys mounted in frames, free to slide in the direction of motion of the band. This, the apparatus for measuring the torque, was placed several feet below the shaft in a convenient place for observation. A second dynamometer was made on the same principle, but arranged to be self-contained. Any machine could be driven through it, and the power given to the machine directly observed. The dynamometer was used to measure the power given to a dynamo. Measurements were made of the work required to overcome the belt friction, journal friction, of the work lost in hysteresis and eddy currents, and of the efficiency of the dynamo at different outputs.

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS.—1897.

[*Compiled expressly for this journal by* W. P. THOMPSON & Co., *Electrical Patent Agents, 322, High Holborn, London, W.C., to whom all inquiries should be addressed.*]

30,065. "Improvements in key switch holders for incandescent electric lamps." J. M. HUISMAN and H. C. GOVER. Dated December 20th.

30,085. "Improvements in electrical contact devices." B. DOYLE and H. V. THIRKELL. Dated December 20th.

30,089. "An improved process for preparation of an electric paste accumulator." E. KOSEL. Dated December 20th.

30,135. "An improvement in vehicles driven by oil engines in connection with electric motors actuated by accumulators." A. L. FYFE. Dated December 20th.

30,157. "Improvements in and connected with the manufacture of electrical cable or conductor conduits." A. MUSKER and F. J. P. CHEESBROUGH. Dated December 21st.

30,205. "Improvements in coin-controlled mechanism for electric and other meters." W. F. BROWNE. Dated December 21st. (*Complete.*)

30,211. "Improvements in and relating to insulating blocks for electric conductors." W. P. THOMPSON. (J. Jungbluth, Germany.) Dated December 21st. (*Complete.*)

30,221. "An improved electric fuse and machine for the manufacture thereof." N. SCHMITT. Dated December 21st. (*Complete.*)

30,246. "Improvements in arc lamps for projection." L. STUART and J. H. BARTON. Dated December 21st.

30,247. "An improved centreing motion for arc lamps and limelight jets." J. STUART and J. H. BARTON. Dated December 21st.

30,253. "An improved electro-chemical explosive device." H. H. LAKE. (G. Cornara, Italy.) Dated December 21st.

30,256. "Improvements in electrical resistances." A. J. MARQUAND and F. G. TREHARNE. Dated December 21st.

30,259. "A method or methods for controlling a mechanism or mechanisms by means of electric or electro-magnetic waves of high frequency." E. WILSON and C. J. EVANS. Dated December 21st.

30,264. "Improvements in and relating to windings for polyphase machines." THE BRITISH THOMSON-HOUSTON COMPANY, LIMITED, and H. M. HOBART. Dated December 22nd. (*Complete.*)

30,275. "Improvements in dynamo-electric machines." T. E. WEAVER. Dated December 22nd.

30,277. "A porcelain insulator disc for capped incandescent lampholder." W. D. HASSALL. Dated December 22nd.

30,295. "The automatic locking lever and lifting lever combination for electrical lifts, cranes, or other machinery." C. E. B. HOLT. Dated December 22nd.

30,299. "Improved means for making electrical connections upon railway trains." J. E. DUCKWORTH. Dated December 22nd.

30,341. "Improvements in and relating to electric smelting furnace." W. ANTROBUS. Dated December 22nd.

30,347. "Improvements in electrical arc lamps." E. P. L. MORS and L. C. A. POTTIER. (Date applied for under Patents, &c., Acts, 1883, Sec. 103, November 3rd, 1897, being date of application in France.) Dated December 22nd.

30,364. "Improvements in phase transformers for electric currents and the application of the same to monophase electric motors." E. B. WEDMORE. Dated December 22nd.

30,393. "An electro-mechanical dancing marionette figure in combination with rubber rotating sphere for advertising purposes and such like." J. G. KNIGHT. Dated December 23rd.

30,441. "Improvements in primary and secondary galvanic batteries." C. L. R. E. MENGES. Dated December 23rd.

30,445. "Apparatus for simultaneously connecting a number of pairs of electric conductors." SIEMENS BROS. & Co., LIMITED, and E. HOLMES. Dated December 23rd. (*Complete.*)

30,447. "Improvements in supplying electrical energy to railways worked by alternating currents." SIEMENS BROS. & Co., LIMITED. (Siemens & Halske, Actien-Gesellschaft, Germany.) Dated December 23rd.

30,470. "An improved electricity meter shelf-fixing, or box and main connection board or box combined." F. W. E. JONES. Dated December 24th.

30,476. "Improvements in and connected with electric traction." H. W. HANDCOCK and A. H. DYKES. Dated December 24th.

30,494. "Improvements in the armatures of induction motors." W. L. WISE. (The Maschinenfabrik Oerlikon, Switzerland.) Dated December 24th.

30,544. "Improvements relating to the electric welding of tubes and to apparatus therefor." O. PARPART. Dated December 24th.

ELECTRICAL PATENTS OF 1884, EXPIRING IN JANUARY, 1898.

We are informed by Messrs. W. P. Thompson & Co., that about 90 applications for electrical patents were filed in the month of January, 1884. Only two of the patents granted for these applications have been maintained to run their full length of term, viz, 14 years, and being of some interest we give short abstracts below.

551. "A new or improved process and apparatus for the extraction of metals from their chlorides or fluorides." L. A. GRATH. (R. Cratzee, Hanover, Germany.) Dated January 3rd, 1884. The object is to obtain metals from their chlorides or fluorides. The metallic melting pot used contains an insulating case with which it communicates by means of holes; this case contains the positive electrode while the melting forms the negative. Rods of the metal, to be reduced with carbon, are placed beside the positive electrode in the insulating case, an inert or reducing gas is brought to the pot, which is provided with an outlet. The chlorine or fluorine passes out of the insulating case through a pipe near the top. 2 claims.

2,235. "Improvements in holders for incandescent electric lamps." C. DARNFELD. Dated January 28th, 1884. Consists of the construction of holders for incandescent electric lamps, the object being to enable the lampholders to be conveniently screwed on to gasoliers, chandeliers, &c., to fit the conducting wires in the lampholder in a commodious way, to protect the same from contact or any external disturbance, as well as to fix the lamp itself into the holder in the simplest way ensuring contact with the conductor. 3 claims. This patent was amended on February 6th, 1890.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., *price, post free,* 9*d.* (*in stamps*).]

1896.

16,270. "Improvements in secondary electric batteries." M. O. A. GARBEAU. Dated July 22nd, 1896. The plates or electrodes consist of a grid or framework, each rectangular space in which is filled with strips of lead alternately of a flat and corrugated shape. These strips are united across their centre by autogenous soldering. The plates are wrapped in parchment paper and mounted on insulating legs.

17,906. "Improvements in crossings of electric conductors for electric railways and tramways." A. T. SNELL, C. E. GROVE and A. F. HILLS. Dated August 12th, 1896. Relates to the arrangement of conductors at cross-over roads on lines using a three-wire system. An insulated conductor at the crossing is placed above or below the working conductors, and electrically connected permanently, or through switches, with one side of the system, and the current is taken to the locomotive or motor vehicle through additional brushes and switches thereon.